Electrical World

The Consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. XLVII. NEW YORK, SATURDAY, MAY 12, 1906. No. 19.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....1139 Monadnock Block
PHILADELPHIA OFFICE.....Real Estate Trust Building
CLEVELAND OFFICE.....405 Cuyahoga Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION

United States, Canada, Cuba and Mexico.....Per year, $3.00
Foreign Countries, within the Postal Union.....$6.00
Great Britain and Ireland.....25 shillings
Germany.....25 shillings
France.....31 francs
Single copy.....10 cents

Remittances for foreign subscriptions may be made through our European office. Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

Copyright, 1906, by McGRAW PUBLISHING CO.

Entered as second-class matter at the post office at New York, N. Y., under the Act of Congress of March 3, 1879.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the ELECTRICAL WORLD 16,500 *copies are printed. Total circulation for* 1906 *to date,* 367,000, *an average of* 19,315 *per week.*

NEW YORK, SATURDAY, MAY 12, 1906.

CONTENTS.

Editorial 973
A. I. E. E. Election..... 976
Local Sections of the Illuminating Engineering Society..... 976
Cornerstone Laid of United Engineering Building..... 976
Convention of the Southwestern Electrical and Gas Association.... 977
Fuel Testing at the University of Illinois..... 977
Central Station Earnings at Red Oak, Iowa..... 977
Damage to Electrical Interests in San Francisco. By C. W. Whitney 977
Massachusetts Central Stations..... 979
Annual Report of the General Electric Company..... 979
Current News and Notes..... 980
Mr. A. S. Richey..... 982
A Japanese Steam Turbine Electric Station..... 983
Another Tungsten Filament Lamp..... 984
Residence Lighting and other Central Station Work at Wabash, Ind. 985
Electrical Engineering at Cornell..... 988
The Depreciation of Electrical Properties..... 990
Test of a Curtis Turbine at Waterloo, Iowa..... 991
Ithaca Meeting of the American Electrochemical Society..... 992
Accuracy in Wiring Calculations..... 995
A Variable-Speed Power Transmission System Using Induction Motors 995
The Electric Furnace in Iron and Steel Manufacture..... 996
New Telephone Patents..... 996
LETTERS TO THE EDITORS:
Liquid Barretter Litigation. By Reginald A. Fessenden..... 998
Temperature Effects in Spans. By C. P. Nachod..... 998
Efficiency of Lighting Balancers. By C. T. Wilkinson..... 998
Digest of Current Electrical Literature..... 998
The Cooper Hewitt Mercury-Vapor Lamp for Industrial Lighting.. 1002
Self-Starters for Alternating-Current Motors..... 1003
Hydro-Electric Power for a Cement Plant..... 1004
Producer Gas Power Plant at Worcester, Mass..... 1004
Entrance Switches and Cut-outs.....1004
Industrial and Commercial News..... 1005
General News 1007
Weekly Record of Electrical Patents..... 1015

THE ENGINEERING BUILDING.

The progress on the new home for the national engineering societies is well evidenced by the fact that when the cornerstone was laid this week by Mrs. Andrew Carnegie the completed walls towered a dozen stories above the little concourse, and the statement was made unofficially that occupancy is hoped for by January 1. Indeed there is no good reason why the building should not be in every way complete before that date, but in these days of strikes and other earthquakes, "you never can tell." At any rate, the Conference Committee and the United Engineering Society that have been giving strenuous days and nights to the work for the past two years are to be congratulated upon the attainment of the present stage of their task. The building is proving to be far more beautiful and stately than even tbe drawings of the architects promised, and the interior arrangements—society headquarters, offices, library, museum, auditoriums, reception rooms, etc.—have been laid out with painstaking study and care. The fact that a dozen bodies and some 20,000 engineers have already concentrated on the spot for their official work is more than justification of the simple pregnant little sentence of Mr. Carnegie when he said that the money given was to create a "home for you all." It is believed the city will contain no more fruitful benefaction than this.

GROWING ELECTRICAL EXPORTS.

It is with great satisfaction that we note how the growth in electrical exports this year has been maintained. The figures for January and February have already been published, showing gains, and now we have corresponding improvement brought to note in the March statistics of the United States Department of Commerce and Labor. The exports of electrical machinery in March were $705,037, as compared with $620,496 last year. The exports of electrical instruments and apparatus were $590,328, as compared with $505,705. Both classes thus exhibit substantial advances, which are brought out even more clearly in the returns for the nine months of the fiscal year. Thus the total of instruments and apparatus is $4,654,800, compared with $3,616,648, while the total of electrical machinery is $5,736,935, compared with $5,290,091. We thus get a total for tne nine months of $10,391,735, a gain only a few dollars short of $1,500,000. Such trade is well worth fostering, and that branch of it relating to small apparatus appears particularly responsive to judicious effort.

GAS VERSUS ELECTRIC STORE LIGHTING.

A walk down the business streets of some towns, especially in Ohio where natural gas is cheap, is not conducive to great pride on the part of the electric light man as to the industry he represents. It must be admitted that in too many cases the general appearance of the gas-lighted store as compared to those lighted by incandescent electric lights is much superior. Where this is true it is due in a large measure to the out-of-date lighting arrangements of the electrically-lighted stores. The incandescent electric lamp, when seen in stores on a street where other stores are lighted with gas mantle burners, looks yellow and sickly when clear glass bulbs are used. The incandescent lamp filament, never a thing of great beauty, looks still worse when in compar-

ison with the whiter and better diffused light given by gas mantle burners within opal glassware. This is not written to boom gas lighting but to point out how electric lighting can be greatly improved. The general appearance of the electric incandescent lamp can be radically changed by the use of roughed or frosted glass bulbs or globes. By this simple change this crudity is at once removed and the electric incandescent lamp can be used on a street where diffused gas lighting is in vogue without causing the electrical man to hang his head in shame.

The Starting Current of Motors.

The *Elektrotechnische Zeitschrift* has recently published the resolutions of the German Machine Standardizing Committee in regard to the starting of motors connected to city mains. The resolutions contain a number of rules for the control of such motors. The existing conditions in German cities have given rise to some dissatisfaction, when polyphase motors have been installed in considerable numbers on city electric lighting mains. The large and copious starting currents that such machines insist upon cause heavy and sudden drops of potential in the supply mains, and a correspondingly noticeable winking on the part of the sensitive incandescent lamps operating on these mains in the neighborhood. If the motors had only to be started once a day—that is, if they ran continuously during working hours—the disturbance to the lamps would not be so serious. Such motors, however, are usually applied either to elevators, or to machinery which has frequently to be started and stopped. Consequently, the lamps connected to mains in the neighborhood of a number of motors are apt to be kept see-sawing in candle-power, to the great discomfort of all who may be reading by them. The remedy for a distress of this character is found either in more copper in mains, more numerous feeding points, or less current in motors. Where a number of motors are actively taking current a good income from the sale of electricity to be expected and a reasonable expenditure in the reinforcement of mains or feeders may be thereby partly guaranteed. On the other hand, however, a reasonable range of restriction should be laid upon the thirst of the motors for current, and motors which take an unduly large starting current should not be permitted to take power from the mains.

The new rules require that all alternating-current motors to be connected must have on their nameplate a statement of the power factor of the machine at full load. It is required that this power factor must reach a certain magnitude according to the power of the motor and the number of phases. Polyphase motors are required to have a full load power factor of 65 per cent in 1-hp size, increasing by steps up to 85 per cent in sizes of over 20 hp. Single-phase motors are allowed a somewhat smaller power factor, commencing with 65 per cent in 1-hp and ending with 82 per cent in sizes over 20 hp. The starting current requirements are similarly graded. In the case of direct-current motors the power taken from the mains at starting may not exceed 2 hp per horse-power of normal capacity in 1-hp size, nor 1 kw per horse-power of capacity in capacities of over 15 hp, unless the starting torque has to be in excess of the full-load torque, when extra allowance is made. Similarly graded requirements attach to the starting currents of alternating-current motors. The volt-amperes taken from the mains in starting must not, for example, exceed 1,500, in single-phase motors, per horse-power of normal capacity in sizes of 5 to 15 hp, unless a starting torque is required greater than the full-load torque. The testing of the starting current is to be made with such ammeters as permit of the pointer being supported in a position slightly below the maximum value attained by the starting current. Hot-wave ammeters are excluded. The power factor is to be determined by joint use of the voltmeter, ammeter and wattmeter at terminals, and at the normal full-load current of the motor. The test is to be made at normal main voltage; but a five per cent reduction in the same is to be permitted. There can be no doubt that where the selection of motors is left open and is subject to close and general competition, there is a considerable variation in electrical quality, and such rules are not only called for, but may exert a wholesome influence upon all sides of the business.

The Reactance Voltage of Direct-Current Dynamos.

When a simple single-phase alternator is connected to a circuit containing inductance its own inductance included, it is well known that the rapid reversals of current in the circuit develop a reactance voltage which must be supplied by the generator in order to establish the alternating current. When a direct-current generator is employed, the external current is steady, and devoid of reactance voltage, but unless the generator be homopolar it has an alternating current in all parts of its armature winding. This alternating current in an armature coil gives rise to a certain internal reactance voltage, which plays an important part in the phenomena of direct-current commutation. During recent years the analysis and comparison of direct-current generators has given rise to the establishment of reactance voltage as one of the criteria of sparkless commutation. It is found that the reactance voltage of a machine for a given output varies only slightly with the armature length. It is open to some discussion at the present time how great the reactance voltage of a machine may be, consistent with satisfactory commutation, but as a limit it seems to be 4 volts. It usually varies with the type of commutator brushes used, between 1.5 and 3.8 volts. The limiting value also varies somewhat if auxiliary or intermediate poles are used to assist commutation, or if the brushes are permitted to be shifted with the load. Nevertheless, if the limiting value of the reactance voltage can be set even roughly and a simple formula can be given for computing it, a distinct advance in the art of designing commutating machines is thereby established.

In a recent issue of the London *Electrician*, Mr. H. M. Hobart offers a simple rule for determining by inspection the reactance voltage of any ordinary direct-current machine. Find the continued product of the gross armature core length in centimeters, the number of armature face conductors, the speed in revolutions per minute and the load current strength per pole in amperes. This product divided by two hundred and fifty millions is the reactance voltage of the machine at that load. If, however, there be more than one turn of armature conductor per commutator segment, the result must be multiplied by the turns per segment. There is also a relatively small correction for the ratio of armature core length to polar pitch, which correction may generally be neglected. This simple formula requires no data to be secured for the machine under consideration other than those capable of being obtained by direct inspection with the aid of a measuring tape. It would be interesting to ascertain the reactance voltage by this rule at full load for as large a number of direct-current machines as possible.

TWO NEW PHOTOMETERS.

Of making photometers there is no end, and much color is a weariness to the flesh. With due apologies to Solomon, we direct the attention of our readers to a couple of photometric papers noted in the Digest with a recommendation to read the originals in full. As we have remarked times without number, no branch of industrial photometry is in so unsatisfactory a state as photometry. Without reliable standards as a basis, and handicapped by the yearly increasing color differences among our commercial illuminants, the art of photometry needs improvement sadly. It is not the instruments that are at fault so much as the methods, involving as they do the almost hopeless comparison between physical and physiological values. The latest form of Lummer-Brodhun screen, or the flicker instrument, allows of making the actual photometric settings with a precision that really leaves little to be desired, but the trouble comes in interpreting the quantity thus found, in translating photometric readings into illuminative values. When the sources are of differing colors this difficulty increases very seriously indeed, and hence arc photometry is especially troublesome. The Lummer-Brodhun screen, although beautifully sensitive, leaves a wide margin for individual differences of judgment in matters of color; and the flicker instrument, if it be true as has been stated, that it can be used by a color-blind observer and a normal observer with coherent results, leaves grave doubts as to the real value of the comparison between colored sources.

The first of the papers here referred to is directed not at color photometry, but at the evaluation of spherical candle-power, and gives a good description of the working of Prof. Ulbricht's spherical photometer, which is merely a large globe coated on the interior with a diffusing surface of white paint. The illumination at a peep-hole in such a globe, the direct rays being cut off, is strictly proportional to the spherical candle-power. Such a globe actually integrates the luminous effects very successfully, although the result has to be obtained by rather complicated instrumental means, including a Brodhun screen, rotating disc and prisms, and an osmium secondary standard. If frequently calibrated by reference to a known source, however, the apparatus affords a very ready means of evaluating the spherical distribution as far as it can be freed from the inevitable color difficulties. It can also be used for determining the mean hemispherical candle-power if anybody wants that value, which may generally be regarded as an apology for a bad spherical distribution. In some few cases it has value—these being with reference to illuminants which are structurally difficult to determine on the spherical basis. Even so, the lower hemispherical candle-power is derived in part from diffuse reflection and should be compared not with the similar distribution from another radiant, but from this as reinforced by a reflector. Apparently the sphere photometer is an accurate and useful instrument within its limitations, and on the whole easier to use than any other form of integrating apparatus. Its agreement with point-to-point readings is certainly very satisfactory indeed, and the measurements can be rapidly taken. We should think that in arc photometry it might be decidedly valuable.

The second paper considered is one by Dr. Torda on a portable selenium cell photometer designed especially for the rapid testing of incandescent lamps. The idea of a selenium photometer is an old one and has been many times tried in one form or another. Quite obviously it is unsuited for the comparison of lights of difficult color since the visible luminous effects are far from being proportional to the effects produced on the cell if the color varies. But for lights varying as little as do incandescent lamps it is no difficult matter to determine an arbitrary relation between light and effect on the cell that will permit easy and fairly accurate comparisons. Selenium cells have a rather bad reputation for inconstancy, so that this relation can hardly be assumed as a constant. By dint of much study, this evil feature has been reduced; but even now the cells would have to be recalibrated from time to time. The apparatus as worked out by Dr. Torda is compact and rather simple to operate, the reading being taken directly from a milliammeter to a relative precision of one or two percent under ordinary conditions. We think that the author rather overestimates, however, the difficulty of lamp comparisons by the ordinary methods. Certainly, the difference in efficiency between an ordinary secondary standard and the commercial lamps usually checked against it is insufficient to introduce any material color difficulty; and in using the same circuit method the effects of difference of efficiency are completely negligible, within the range of voltage variation which can readily be secured in practice. Nor does the selenium cell device have any advantage in speed. The time of a reading, including an automatically obtained period of rest for the cell, is given as 45 seconds. This assumes apparently an assistant to insert and replace the lamp, although at a pinch this could be done by the operator in the period of rest. It is quite certain that this speed could be equaled or beaten, with at least as great precision, on an ordinary photometer bar with a Lummer-Brodlun screen and conveniently arranged for changing the lamps.

Yet both the new photometers here described are useful additions to the resources of applied science within their limits, and we hope to see them find considerable practical application. The real difficulties of the present situation lie far back of the instruments. They begin in fact at the standard of light itself: In spite of all the research which has been spent on the subject, the practical standard used to-day for ultimate reference is the Hefner lamp. The emission spectrum of this radiant is decidedly different from that of commercial illuminants, and in fact it is so distinctly reddish as to involve very serious color-difficulties, rather aggravated by the low intensity of the lamp itself. In this country the English candle is generally the legal standard, so that the Hefner would be of very dubious standing in case of litigation. We have long had a certain regard for the larger pentane lamp as a standard. Used in connection with a Methuen screen it should give exceedingly good results, and both in color and magnitude would be a considerable improvement upon anything we now have. Even given a really first-class standard, the color difficulty is still with us in an aggravated form. It is a tough problem, but since the facts as to normal color vision are fairly well known, it should not be an impossible task to settle on standard conditions of measurement. After all, the radiation which is useful for normal vision under practical conditions of intensity is the only thing which counts. For purposes of illumination ultra-violet light and light of relatively very non-luminous colors have no value and should not be included in the salable candle-power. We hope that at the first opportunity there will be an effort made to get light and photometry upon a really international basis, and to secure uniformity of laws relating to the subject. Here is a good steady job for the Illuminating Engineering Society and allied bodies in this and other countries.

A. I. E. E. Election.

Much comment and no little indignation has been excited among the membership of the American Institute of Electrical Engineers by the issue of another election circular calling upon those who voted for Mr. E. W. Rice, Jr., for president to write to the secretary of the Institute for the return of their ballot, and asking that a ballot enclosed with the circular and headed by the name of Professor Sheldon be substituted for the one returned. The circular is undated and no place of issue is given. It appears to have been mailed to a selected list of names, and its issue did not become generally known until some days after it had been sent out, thus, as in the case of the Philadelphia bogus nomination circular, precluding action to counteract its effect prior to the closing of the balloting for officers. Another extraordinary characteristic of the circular is that signatures were attached to it without the consent or knowledge of those whose names were thus made use of.

We have received the following communication from Mr. L. B. Stillwell, who informs us that he did not see the abovementioned circular, to which his name is appended.

About two weeks ago I consented to the use of my name as a signer of a printed circular advocating the election of Dr. Sheldon to the presidency of the Institute. At that time I stated to the gentlemen who prepared the circular that, in my judgment, it was so worded as to emphasize overmuch the idea of service in Institute work as a necessary preparation for the office of president, and in view of the fact that several gentlemen, whose names appeared with mine as signers of that document, have since published letters in which this view is still further emphasized and elaborated, I deem it proper to say that, in my opinion, in the selection of candidates for the presidency professional eminence should come first and service to the Institute should be a secondary consideration. In expressing this opinion I do not mean to imply that service to the Institute is unimportant. My feeling, however, is that service in enlarging the science of electricity and in advancing the art of its application, whether such service be rendered inside or outside the Institute, is properly the primary and controlling consideration, provided, of course, that the man who has rendered such service is qualified, by ability and willingness, to make an efficient president.

When it happens, as in the present case, that each of two candidates is well qualified by professional standing, their comparative ability to advance the interests of the Institute as an organization should be taken into account; but I do not find myself at all in accord with the idea apparently entertained by certain members that the office of president should be reserved exclusively for those who have risen from the ranks by attending to committee work.

I am supporting Dr. Sheldon in the pending election and hope to see him elected, but I am not doing this primarily because of his long and useful service as a vice-president and manager of the Institute and chairman of the Committee on Papers.

The following communication has also been received from Mr. Herbert A. Wagner:

It seems necessary for me to ask again for a little space in your columns to express my disapproval of the methods being used in the present campaign for the presidency of the A. I. E. E.

Yesterday I was surprised to hear that a second circular letter had been sent out to a limited number of Institute members enclosing a secret ballot bearing the name of Dr. Sheldon and suggesting that members who had cast their votes for Mr. Rice could change their votes by using the enclosed ballot and signing certain papers and documents also enclosed. I have not seen one of these circulars, but am informed that my name appears among the subscribers thereto.

This use of my name is entirely without my sanction and a total surprise to me. I did assent to the use of my name in connection with a certain circular letter sent out early last month asking members to work for Dr. Sheldon's election, as stated in my letter appearing in your last issue. This consent, however, was specific and did not permit the use of my name as an endorser of any other communication.

As to the suggestions said to be made in the recent circular, I am most strongly opposed to them and consider it a decidedly improper and undignified proceeding to try to withdraw and change a vote once cast, or to endeavor to induce others to do so. It detracts greatly from the dignity and honor of an office which ought to be thrust upon one, as it were, almost without the seeking, to have it made the object of a heated and acrimonious contest resembling an ordinary political campaign.

The welfare, dignity and influence of the Institute are being sacrificed by these campaigning methods instead of being protected against outside influences as alleged.

Local Sections of the Illuminating Engineering Society.

A New England Section of the Illuminating Engineering Society has been organized with the following officers: Chairman, Mr. John Campbell; secretary, Mr. J. H. Stickney; managers, Mr. E. N. Writington, Mr. C. L. Edgar, Dr. Louis Bell and Mr. A. T. Sampson. Local sections will also be organized in Chicago and Philadelphia. Two meetings of the New England Section have been held, one in March, at which the papers presented earlier in that month in New York were read and discussed; and another on April 24, when the papers presented April 12 in New York on interior illumination were considered. At this later meeting the reading of the New York papers was prefaced by a paper by Mr. N. W. Gifford entitled "Some Suggestions from the Gas Side," and a talk by Dr. Louis Bell on "Illumination," in which he outlined the problems which concern illuminating engineers, and particularly the Illuminating Engineering Society.

Corner Stone Laid of United Engineering Building.

Last December Mrs. Andrew Carnegie laid the cornerstone of the new Engineers' Club on West Fortieth Street. On May 8 she performed the same ceremony for the new United Engineering Building on West Thirty-ninth Street. The two great structures stand back to back "four square," between Fifth and Sixth Avenues, and are already very far advanced toward completion. The exercises in both instances were quite informal, as no extensive celebration will be attempted until both buildings are actually finished and available for occupancy.

Last Tuesday at 5 p.m. a small party assembled at the foot of the beetling wall of the new home of the national engineering bodies, to witness the modest function. Mr. E. E. Olcott, president of the United Engineering Society, made a few brief, pithy remarks, and then asked Mrs. Carnegie to address herself to the task. She first placed in the box to go into the stone a number of new coins, a Bible, copies of the daily papers, copies of the latest year books and transactions of the three "founder" societies, and a gold plate whereon was inscribed Mr. Carnegie's terse letter giving $1,500,000 for the enterprise. The box being sealed and deposited, Mrs. Carnegie was handed a beautifully inscribed ivory mallet and silver trowel, and the big stone being slid into place she dabbed the mortar, tapped it and declared it well and truly laid, amid cheers. Little Miss C. Olcott then presented her with flowers, while Mr. Carnegie, in response to enthusiastic calls, climbed on a kitchen chair and got off a witty speech in his best vein. He declared his happiness in making a gift to the professions, of such a building, where all would be at home, for Americans were the "best mixers on earth," and the need of engineers was great. He quoted Kipling's "McAndrews' Hymn" with due emphasis on the line, "O, Lord, ye ken ye need an engineer." He concluded with the remark that he looked forward eagerly to being present at the early opening of both the Building and the Club House.

The space being so limited only those directly concerned in the work were present, including the architects, Messrs. Hale and Morse, C. H. Haswell, John Fritz and Messrs. C. Wallace Hunt, F. R. Hutton, S. S. Wheeler, R. W. Pope, G. H. Guy, R. A. Franks, J. M. Dodge, T. C. Martin, R. W. Raymond, C. W. Rice, W. H. Fletcher, C. Kirchhoff. A telegram of regret at absence was received from Mr. C. F. Scott, who for two years past has presided over the unintermitted labors of the Conference Committee, responsible for the execution of the great undertaking, which in the two buildings will involve a total expenditure of about $2,750,000.

Convention of the Southwestern Electrical and Gas Association.

Final arrangements have been completed for the annual convention of the Southwestern Electrical and Gas Association, which is to be held at Galveston, May 16, 17, 18. A very interesting and attractive program has been prepared by the committee, and the papers to be presented are unusually instructive.

Mr. Stichter, editor of the "Question Box," reports that although this is the first year of the inauguration of this feature, widespread interest has been shown by the members of the Association and outside electrical, gas and telephone companies, and that he has received numerous questions concerning each branch of the Association, the answers and discussion of which at the convention should prove both valuable and interesting.

A pleasing entertainment has also been provided for each day of the convention, including a tour of inspection of the grade raising work of the city, the sea wall, and the dredging apparatus used in connection therewith, the latter through the courtesy of the engineers in charge of the work having been retained so that its operation might be seen by those at the convention.

On the night of the 17th, the Sons of Jove will hold a grand rejuvenation and initiate their new members into the mystic orders of their association, and will have their parade, which is to be more spectacular than on any previous occasion.

The Galveston Business League's rooms in the Tremount Hotel have been selected as headquarters of the convention, and many applications for reservation of rooms have already been received. Special prices have been obtained and those expecting to attend it are requested to make application for accommodations, stating number of rooms, whether with or without bath. These should be addressed to Mr. H. S. Cooper, chairman of the Entertainment Committee, care of the Galveston Electric Company, so that all may be provided for and avoid confusion and misunderstandings upon arrival. Arrangements are being made by the committee for special rates on all railroads.

Fuel Testing at the University of Illinois.

The personnel of the committee having the direction of the important fuel testing work to be conducted at the University of Illinois is composed of representatives from various State engineering and commercial organizations as follows:

Mr. H. Foster Bain, director State Geological Survey, representing the State Geological Survey. Mr. A. Bement, consulting mining and mechanical engineer, representing the Western Society of Engineers. Mr. Edwin H. Cheney, president Fuel Engineering Company, representing the Building Managers' Association of Chicago. F. H. Clark, general superintendent of motive power, Chicago, Burlington & Quincy Railroad, representing the Western Railway Club. Mr. Adolph Mueller, president H. Mueller Manufacturing Company, representing the Illinois Manufacturers' Association. Mr. Carl Scholz, president Coal Valley Mining Company, representing the Illinois Coal Operators' Association. Mr. A. B. Schroeder, general manager of Springfield Gas & Electric Company, representing the State Electric Light Association. Mr. William L. Abbott, chief operating engineer of Chicago Edison Company, representing the Board of Trustees, University of Illinois. Prof. L. P. Breckenridge, professor of mechanical engineering, University of Illinois, representing the Engineering Experiment Station, University of Illinois.

Central Station Earnings at Red Oak, Iowa.

Mr. D. F. McGee, manager of the Red Oak (Iowa) Electric Company, has brought about a remarkable development of the central station business in that little city which is of about 5,000 inhabitants. The gross earnings of the plant including electric central station service and hot water heating are $7.35 per capita of population per annum. Of this about $6 per capita is from electric service. The company is running practically all of the machinery in town. It has a contract for city water pumping, and has entirely driven out the small steam and gasoline engine plant. So much all day power business has been secured that the average load for the day is 90 per cent of the maximum peak load. This is accomplished by securing power contracts which are not on during the peak period. The company has 600 residence customers connected, which also is a remarkable showing for a town of 5,000 inhabitants. An average of about 6 new residence customers are connected per month. Mr. McGee, as manager, does all his own soliciting. A large power business is secured by making low rates for non-peak users. Since a hot water heating system is operated it is important to have a good day load, and this the company has. In soliciting residence business Mr. McGee's general policy has been to make it a point to secure as customers certain residence owners in every neighborhood which are likely to set the pace for others and whose example is likely to be followed. The plant affords an excellent example of what can be done in the development of the central station business in a small town by properly directed effort, and a sound business policy. The property is paying a fair profit on the investment and is laying aside regularly a certain amount for depreciation and retirement of its bond issue. This sinking fund is placed in the bank and can be used by order of the directors to purchase securities of the company issued to pay for profitable extensions or enlargements of plant.

Damage to Electrical Interests in San Francisco.

BY C. W. WHITNEY.

It is very hard, indeed, to form even an approximate estimate of the damage to electrical and allied properties in San Francisco. At this writing, 13 days after the earthquake and eight days after the fire burned itself out, no one can get a fair idea of the extent of the devastation. It is true that business firms are making every effort to resume, but it will be not only weeks and months, but years before conditions can be brought to a normal state. The spirit of the citizens and business firms, backed up encouragingly by the daily press, is a splendid evidence of an unfailing faith in San Francisco, and is, of course, necessary in the trying times that are now being experienced, but these enthusiastic hopes cannot conceal from those on the ground the actual conditions of affairs.

ELECTRIC LIGHTING PROPERTIES.

To speak of the damage to electric light and power interests, means to refer almost exclusively to the properties of the Pacific Gas and Electric Company, the large holding company, capitalized for $30,000,000, which was organized early in the year to take over the California Gas & Electric Corporation and the San Francisco Gas & Electric Company. This company had its offices on the eighth, ninth and tenth floors of the new Shreve Building, at the corner of Grant and Post Streets. These offices were entirely burned out, although the building, being a Class A structure, still stands. Only those few records which were hastily removed and those which were placed in the vaults were saved. Temporary offices have been located in two or three points in Oakland and the engineering staff under Superintendent F. G. Baum, is temporarily occupying the old

power station in Oakland at Grove and First Streets on the water front.

The greatest damage to the Pacific Gas & Electric Company's plants was in San Francisco, the hydro-electric stations of the California Gas & Electric Corporation not being damaged in the least—in fact the earthquake was not felt in most sections in the mountains.

In San Francisco, the San Francisco Gas & Electric Company lost eight sub-stations and two power stations, including the

FIG. 1.—RUINS OF JESSIE STREET STATION.

station near the center of the city which was nearly destroyed but a few weeks before by fire. The old Independent gas and electric plants in the Potrero district, were not seriously injured and the electric station is now ready for operation. As soon as the necessary permit is issued jointly by the lighting committee, of which Rudolph Spreckels is chairman, and Chief Hewitt of the Department of Electricity, the Independent plant will furnish current for street arc lights along three different routes, covering the principal section of the unburned district. Light and power will also be supplied to various industrial concerns that have already been granted permits to resume operation when power is available.

The only other electric generating station not crippled by the earthquake and fire is that of the Mutual Electric Light & Power Company on Shea Street, near the water front. The Mutual Company is in a position to resume operations on a large scale, the only damage it suffered being confined to one of its water mains, which has already been repaired. Over 30 permits have thus far been granted to industrial concerns in the burned district in the vicinity of the Mutual plant. Just when the power will be turned on cannot be learned at present. A careful inspection of the wires throughout the usual power circuits must first be made, as in many sections the wires are lying on the ground and in other places are hanging within reach of pedestrians and workmen, so that great precaution must be taken before any power can be turned on.

When one realizes that for 12 days not an electric or gas light has burned in San Francisco, one can appreciate the unfortunate position in which the citizens and business houses are placed. Candles and oil lamps reign supreme and even they must be extinguished by 10 p. m. by order of the military officials in control. Of course, with no water supply, or at least a very inadequate one in a limited section of the city, no chances can be taken that might permit another conflagration.

The gas works and systems of the San Francisco Gas & Electric Company suffered an enormous loss. While the Potrero plant is practically ready for business, the mains over the entire city are in a questionable condition. The North Beach gas plant was not touched by the fire, but was badly wrecked by the earthquake. The large gas holder, however, escaped serious injury and can be used.

The prospect of securing gas for lighting and heating purposes seem to be quite remote as compared with the prospect for resumption of electric lighting. The underground conduits of the San Francisco Gas and Electric Company are believed to be in fairly good shape, but the gas mains, like the water pipes, were greatly damaged by the earthquake. That innumerable leaks occurred in the gas mains as a result of the earthquake was pretty well demonstrated on the first day of the disaster, as well as on the succeeding day, when countless explosions, due to the accumulation of escaping gas, occurred beneath the street pavements. It will take some time to repair all the breaks in the gas mains, while on the other hand, temporary wires for carrying electric power can be strung on poles, and are now being so strung quite generally throughout the city.

As already mentioned, at this writing, it is extremely hard to estimate the amount of damage to the electric light and power systems in San Francisco. Mr. F. V. T. Lee, assistant to the president of the Pacific Gas & Electric Company, places the figure conservatively at $1,000,000, but other estimates run as high as $3,000,000, to say nothing of the loss of revenue from the light and power consumers.

The new Marti station in the Visatacion Valley, south of San Francisco, was also quite badly shaken up by the earthquake. The frame of one of the 5,400-hp gas engines being installed there was cracked, the walls and roof trusses were twisted somewhat, the small exciter battery was completely wrecked and some of the other machinery was damaged. The generators seemed to have received no damage whatever. It is probable that the total loss on the station will not greatly exceed $25,000, although this estimate is only very approximate.

THE TELEPHONE SITUATION.

Although the loss to the telephone system is great enough it is not as large as the public was led to suppose at first. General Manager Glass announced that the losses, as far as they can estimate them are approximately $1,800,000, against which an insurance of $1,060,000 was carried.

The entire underground system is practically intact, which fact will simplify, in a great measure the restoration of the telephone service throughout the city. The lateral cables, where they entered the block, were burned off, and forces of men are now at work cutting off these laterals in the manholes and soldering them up to keep out moisture. In regard to the condition of the Sunset Telephone and Telegraph Company, General Manager Glass says: "We have lost, so far as we can estimate, about 33,000 subscribers out of 52,000. We lost six

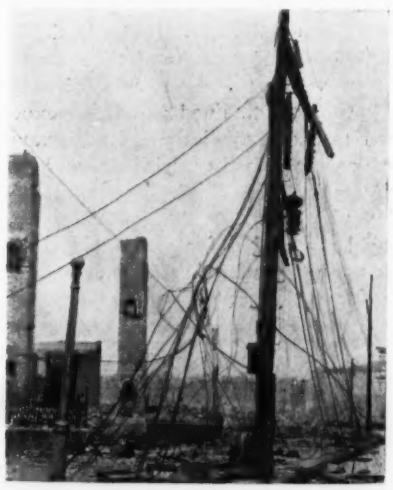


FIG. 2.—FALLEN TELEPHONE AND ELECTRIC LIGHT WIRES.

operating buildings, in addition to our main executive building on New Montgomery Street.

"All our outside systems, including our long distance lines, were unaffected by the earthquake, and since we restored connections through the burned district we have handled more long distance telephone business than ever. We have been doing a tremendous business. The fire seems to have created a boom in telephoning."

TELEGRAPH SERVICE.

For the first time in its history San Francisco was absolutely without telegraphic communication with the outside world for three hours on the morning of April 18. Following the earthquake, which occurred at 5:14 a. m., and for three hours thereafter, not a single wire of the score or more usually in operation was in service. The central office buildings of the Western Union

and Postal Telegraph Companies were both partially wrecked by the earthquake, and later in the day were laid in ruins by the terrific fire. You have already given many details of the events that followed.

To illustrate the heroic efforts made by the companies to restore service and communication with the outside lines, the following graphic description from the San Francisco *Chronicle* is given of one incident: "Quick to realize the havoc which could be wrought by so mighty a trembler as that which preceded the big fire, Harry Jeffs, wire chief of the Western Union Telegraph Company, who lives in Oakland, lost no time in reaching the Southern Pacific mole for the purpose of testing the scores of wires which emerge from the water at that point. It took the expert but a few moments to ascertain that communication in San Francisco beyond the Ferry building was entirely cut off Not an instrument responded to his efforts. Turning his attention to the wires extending from the end of the pier to the various stations leading out of the State, Jeffs found that they had been hopelessly 'killed' by the great shake.

"The seriousness of the situation called for quick action, for aside from the great monetary loss to the company resulting from even a short interruption of the service, was the seriousness of being entirely cut off from the outside world. Securing an engine, the wire chief started out from the mole, and climbing poles at intervals along the way, tested the wires to locate the break. In this way he covered the entire pier until he reached the shore at West Oakland. Here, at a pole almost at Land's End, after calling on each dead wire separately, he at last received a response from Sacramento, and knew that he had at last found the point of severed communication.

"Perched upon a thirty-foot pole, Jeffs gave the capital the first story of the disaster sent out by wire at 8:30 o'clock in the morning. In quick succession, by means of relays, Los Angeles, Salt Lake, Denver and other places heard of the calamity that had befallen the metropolis of the Pacific Coast. For eighteen hours Jeffs stuck to his lofty perch."

Massachusetts Central Station.

The report of the Board of Gas and Electric Light Commissioners of Massachusetts, which has just been issued, shows that on June 30, 1905, 68 companies in that State were engaged in the supply of only electricity and 26 in the supply of both gas and electricity. In addition 19 towns and three cities have municipal plants.

Of the municipal plants, the largest is that of Holyoke, the investment being $1,840,040; next in size are the municipal plants of Taunton, Wakefield, Westfield, Howell, Chicopee, Braintree, Marblehead, Middleborough, Peabody and Concord, the investment in each case exceeding $100,000. In 1905 the Legislature passed an act requiring that municipalities should not fix the price of electric light at a rate less than cost, plus 5 per cent per annum for depreciation. The Board reports that while charges for depreciation at this rate have been reported, no actual provision to meet depreciation has been made, the moneys not being required to be set apart and invested to accumulate, but may be used for actual renewals and reconstruction or invested in new and additional plants. The Board asks that the act be so amended as to give it authority to direct what disposition shall be made of the fund.

While official inquiries relative to the establishment of municipal plants have been received from all the cities and substantially all the towns in the State in which the population exceeds 1,500, no municipal plants were established during the year.

The income of all the municipal plants of the State during 1905 was $287,189, an increase of $51,000 over the previous year; the expenses were $352,019, an increase of $31,000 over the previous year. Adding interest on boards, depreciation charges and minor items, the total expenditures for town and city lighting were $222,382. The balance sheets of the municipal plants show a total of assets of $3,488,373.

The total income of the private electric light stations during 1905 was $8,108,265 and the expenses $4,777,248. The apparent profits of the electric light companies were $2,696,327; against this sum are charges for interest, dividends, depreciation and sundry items amounting to $3,012,547, leaving an apparent deficit for the year of $93,207. These statistics apply to 83 companies, of which four did not earn expenses and 30 did not earn sufficient to warrant the declaration of any dividend. The assets of 62 companies supplying electric light only are $33,520,122. Of these companies 50 show an aggregate surplus of $1,262,710, and 12 an aggregate deficit of $274,347, leaving a net surplus of $987,362, which, added to $918,408 of reserved and depreciation funds, gives a total reserve of $1,905,770, or an equivalent of 10.4 per cent on the aggregate capital. The private plants during the year paid taxes to the amount of $598,035. This may be compared with total station wages of $585,504, and the total cost of fuel of $991,698.

The total electric lighting capacity of all the companies in 1905 was as follows: 1,555,496 16-cp lamps, an increase of 254,000 over the previous year; 10,058 2,000-cp arc lamps, which is exactly the same figure as for the previous year; 10,068 1,200-cp arc lamps, a decrease of 180 over the previous year.

The above figures do not include small numbers of 10, 20 and 32-cp lamps, and 140 800-cp arcs. There has been a steady decrease in 2,000-cp arcs, which in 1902 numbered 1,279; and in 1,200-cp arcs, which in 1902 numbered 13,238.

Annual Report of the General Electric Company

The fourteenth annual report of the General Electric Company to the stockholders has just been issued, and is a most striking evidence of the great prosperity enjoyed by the corporation and by the electrical industry in 1905. The company received orders for apparatus worth $50,044,272; billed out, $43,146,902, and collected, $44,419,613—all these figures far exceeding in its previous history—an average rate of increase of 13 per cent. being shown for the last ten years. President C. A. Coffin in his report said: "The profits of your company for the past year (including $173,389.52 from securities sold, and $798,539.27 from royalties, dividends, sundry profits, etc.) after deducting all patent, general and miscellaneous expenses, and allowances for depreciation and losses, and $1,838,362.46 from factory plants and machinery, were $7,319,160.61.

"The sales billed by your company to its customers for the past year were about $4,000,000 more than for the previous year, showing an increase in business done of about 10 per cent.

"It will be observed that the amount written off factory plants and equipment is substantially 78 per cent. of the cash expended thereon during the year."

Vice-President Eugene Griffin in his report recapitulated some of these data. He stated that during the year the company had received orders for 300,000 hp of heavy traction motors and 750,000 hp of all classes of railway motors. The number of cars equipped with Sprague-G. E. multiple unit control was 4,026. The operation of the New York Central direct-current electric locomotive was reported by the railroad to involve a total maintenance cost one-fourth that of a steam locomotive. At the end of January it had made 29,568 miles in 172 days of actual running time. The average daily run was 171; the maximum for one day was 347 miles in 8¾ hours. Meantime numerous orders had been received for single-phase apparatus for railways. In the Curtis steam turbine department, up to February 1, 1906, orders had been received for 535 turbines and 346 had been shipped. From 11 foreign countries orders had come for 44 turbines.

General Griffin reported that 208,229 separate supply orders, not including contracts, had been received, an average of 694 per working day, or 124 more per day than in the previous year. He added: "The outlook for the coming year is promising. The orders for February and March exceed the orders for the same months of 1905. There is every indication that our business for this year will tax our maximum factory capacity to the utmost. Our unfilled orders to-day are considerably in excess of such orders at any other date in the history of the company."

Third Vice-President E. W. Rice, Jr., makes a full report on the operations of the company from the factory and technical end, and gave numerous details as to extensions to the different works. "Expenditures aggregating $2,338,362 have been made during the year for real estate, erection of new factories, extensions to existing buildings, additional machinery, patterns, special tools, furniture, etc. The following table shows approximately the floor space and the number of employees during the last five years:

	Floor space.	Employees.
1902	2,500,000	15,000
1903	3,000,000	18,000
1904	3,700,000	17,000
1905	4,100,000	18,000
1906	4,350,000	22,500

"The land area of all three plants is now about 439 acres. The total book value of the Schenectady, Lynn and Harrison factory plants, including both land and buildings, is $4,843,812.88 or about $1.10 per square foot of manufacturing floor space."

Mr. Rice makes note of the important long-distance power transmission plants of the company, and says as to newer apparatus: "The size of the transformers used in lowering and raising the voltage in alternating current work has steadily increased until we are now regularly manufacturing units of 10,000 hp capacity. Our line of steam turbine generators has been extended and improved. We have designed and sold a number of turbines of 12,000 hp rating, each capable of delivering a maximum output of some 18,000 hp. We have delivered to the New York Central Railroad four of the eight 7,000 hp turbo-generators ordered last year.

"The first of the New York Central locomotives has been subjected to a mileage test under the control of the New York Central; on April 2, the total run to that date was 40,324 miles. The performance has been extremely satisfactory.

"One of the notable contracts taken during the past year is for the electrification of the West Jersey and Seashore Railway, between Camden and Atlantic City, N. J., a distance of 64 miles. This is the first instance of the electrical equipment of an important steam railroad from terminus to terminus. The contract covers the complete installation including buildings for power house and sub-stations, motors, car equipment, and everything pertaining to an electric railway system."

Treasurer H. W. Darling, in his report, says: "During the year there was expended in acquiring sundry patents, for the use of patents, and in patent litigation, $431,247.13, which has been treated as ordinary expenses of the year.

"In addition, the amount of $1,000,000 has been charged to profit and loss, leaving the company's patents, franchises and good will standing at $1,000,000.

"The company has no note payable. During the past year the company has not borrowed money or incurred obligations; nor has its credit been used either by issuing notes, indorsing customers' paper for discount or lending its name in any way."

During thirteen years there has been written off $15,370,901 for factory depreciation, leaving the book value of the three huge plants only $8,000,000. The company owns $10,104,450 in stocks and bonds of other companies, not inclusive of 89 blocks of securities carried at $1 per lot. The company has 17,000 customers on its books, and had $16,287,018 in notes and accounts receivable. Its accounts payable were $2,106,683.

American Society of Model Engineers.

This society held its second meeting at the Berkeley Lyceum, 19 West Forty-fourth Street, New York, May 2. There was a good attendance and several new members were enrolled. Mr. Barclay gave a half hour's talk on "Shop Work with Lathe and Shop Tools." This was followed by a discussion on various subjects, including the slide valve. Mr. Stoye gave a concise explanation of the locomotive slide valve and the link motion. Members present were requested to bring samples of their work for exhibition at the next meeting. Mr. W. E. Spon, 123 Liberty Street, New York, is secretary of the Society.

CURRENT NEWS AND NOTES.

A. I. E. E. ANNUAL ELECTION.—The annual meeting of the American Institute of Electrical Engineers will be held in the library of the New York Edison Company, 44 West Twenty-seventh Street, New York, on Tuesday, May 15, at 8.15 p.m. No papers will be read or discussed at this meeting. The secretary will present the annual report of the Board of Directors, and the Committee of Tellers will announce the result of the election of officers of the Institute.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—Convention Circular No. 2 of the National Electric Light Association relates to traveling and hotel arrangements for the Atlantic City convention. Special arrangements have been made with about 50 hotels, a list of which is given in the circular, together with their rates. Arrangements may be made directly with the hotels or through the chairman of the convention committee, Mr. Arthur Williams, 55 Duane Street, New York. Mr. George F. Porter, master of transportation, has made favorable arrangements regarding railroad rates from all parts of the country.

THE METRIC SYSTEM.—The American Chamber of Commerce of Paris at a recent meeting adopted resolutions commending the campaign of the *New York Herald* in favor of the adoption of the metric system by the departments of the government of the United States. At the same meeting Mr. James Gordon Bennett was unanimously elected an honorary member. The resolution states that the disadvantages arising from the confusion of American weights and measures are known to all students of the question, and especially to those engaged in international trade; and that while the importance of profitable foreign trade in national development is questioned by none, it should be recognized that weights and measures remain a factor in the strenuous competition prevailing for the rapidly increasing world commerce.

SUBSTITUTE FOR PLATINUM IN ELECTRIC LAMPS.—In a patent granted May 1 to Mr. H. F. Wood, a description is given of a method of constructing incandescent electric lamps by which, instead of securing the vacuum-tight joint by platinum, use is made of a band of copper shrunk tightly about a portion of the glass envelope to form therewith a vacuum tight joint. Each conductor which supports the usual filament passes radially outward to a copper ring which is shrunk about a tubular portion of the bulb. The rings are such diameter that they may be easily passed over the tubular portion. After the rings are in position, the parts are heated until the glass becomes soft. Air pressure is then exerted to force the glass into intimate contact with the rings. When cool, the rings, having a higher coefficient of expansion than the glass, necessarily contract faster, and thus shrink tightly about the glass, and form an air-tight joint. The rings are made exceedingly thin—about one one-hundredth of an inch—in order that the glass may not be cracked or sheared by the force of contraction of the ring.

"THE GREAT WHITE WAY" is the popular name for that section of upper Broadway, New York, which is the heart of the shopping, restaurant and theatre district, extending from Twenty-third to Forty-second Street. According to the *New York Herald*, whose building is midway on the line of route, there are along the street, in that distance 118 arc lights and 36,872 incandescents. It is the most brilliant and concentrated illumination in the world. "These are on the walls and over the doors of sixteen theatres, telling of the play that is expected to allure the lover of the drama; they appear where the clicking balls of the billiard table and the rumbling spheres of the bowling alley make their appeal; they are displayed where the soothing tobacco weed is for sale, where the appetite for food and drink can be satisfied, and where nearly every need of the inner and outer man can be supplied. All of this expenditure of light means a heavy cost that now amounts to about $875,000 annually when all the lights of the great district are considered."

TELEPHONE RATES.—The International Telegraph Bureau of Berne, Switzerland, has issued the second edition of its compilation of telephone rates. This consists of a volume of 498 pages containing the telephone charges of all the principal countries of the world, in which the telephones are operated by the government.

CANADIAN WATER POWERS.—The Ontario government has notified parties who may be interested in water to be utilized for power purposes, not to make any further arrangements, as it is its intention to take over all the electric power developed in the province and arrange with the municipalities for the sale of the electricity at cost.

AMERICAN PHYSICAL SOCIETY.—The next meeting of the American Physical Society will be held in Ithaca, N. Y., in conjunction with the meeting there of the American Association for the Advancement of Science, beginning on June 29. At this time also the new physical laboratory of Cornell University, which has just been completed, will be formally dedicated.

TELEPHONY IN NEW YORK.—The telephone system of New York has continued to grow rapidly in the last four months. Since January 14,807 new telephones have been installed, making the total number in service and under contract 256,962. This is two and a half times as many telephones as London has, more than five times the number of telephones in Paris, and nearly four times as many telephones as Berlin has.

MARDI GRAS ILLUMINATION.—In honor of the annual Mardi Gras celebration at New Orleans, the New Orleans Railway & Light Company has published a handsome booklet containing views of some of the finest electrical lighting decorations used during the festival and operated by power furnished by the company. It is a good indication of what can be done in the way of utilizing electrical facilities on such special occasions.

CALCIC HYDRATE FOR BALLOONS.—M. Moissan has presented to the French Academy of Sciences a note by M. Jaubert proposing the use of calcic hydride (hydrolithe) for the inflation of balloons. By the simple action of water pure hydrogen is released in enormous quantities in the same manner that acetylene is released from calcic carbide. One kilogramme of this material will give 1,000 litres of gas at atmospheric pressure. It is stated that hydrolithe is now made on a large scale in French electrochemical works.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION.—The annual convention of the Texas Independent Telephone Association was held at Waco on April 26 and 27. Representatives of about 30 of the independent telephone companies of the State were present. A feature of the meeting was the organization of a telephone clearing house association, of which Mr. J. B. Earle, of Waco, was elected auditor. The following officers for the ensuing year were elected: President, Mr. J. C. Casler, of Fort Worth; vice-presidents, Mr. C. W. Roberts, of Aberline, Mr. C. A. Wilson, of Granger, and Mr. Thomas O'Rourke, of Shreveport; secretary and treasurer, Mr. C. A. Shock, of Sherman.

WIRELESS AND TELEPHONY.—According to the Wyoming *Tribune,* of Cheyenne, Wyo., the city lines and long distance toll lines out of Cheyenne of the Rocky Mountain Bell Telephone Company were rendered inoperative during business hours for several days owing to wireless telegraph interference from Denver, Col. Although Cheyenne is 100 miles distant from Denver, the wireless messages were transferred to all the telephone wires in Cheyenne and the toll lines running out of the city. The dots and dashes of the Morse code could be easily read and sounded in the telephone receiver like the buzzing of bees, the noise being so loud that it was impossible to talk over the lines. The station at Denver is stated to employ 50 kw in wireless transmission.

RADIOACTIVE STANDARD.—At the April meeting of the British Roentgen Society, the need of a radioactive standard was discussed, and the council of the society instructed to appoint a committee to study the question. One of the standards mentioned at the meeting, that of Mr. Phillips, who proposes to define the c.g.s. unit of radioactivity as that radiation which in dry air at standard pressure will, in unit time, diselectrify a metallic sphere of unit radius charged to unit potential, the sphere being placed at unit distance from the source of radiation. It was further suggested that the practical unit should be a specimen of radium whose radioactivity should be some multiple of the absolute unit, and that this practical unit should be deposited in the National Physical Laboratory. It was brought out that a solution of iodoform and chloroform has been used for the measurement of radiation. Another method consists in the use of a gold leaf electroscope of defined capacity entirely insulated from all external sources. The rays are measured by the leak which the irradiated air causes in the gap between the supporting rod of the electroscope and an earthed plate. The number of free ions in this air gap which carry the electricity across depends only upon the activity of the ionizing rays which penetrate into the chamber containing the air gap.

ELECTRICITY IN PRINTING.—Mr. John Norris, business manager of the New York *Times,* gave out recently some data as to the economy of the central station service from the New York Edison mains. He says: "The consumption of electricity in The Times Building is less than 40 per cent of that estimated by the engineers in planning for our new building. By adopting central station service and avoiding the use of the isolated plant, we saved $80,000 on cost of installation. The cost of operation for 1905 was $19,000 less than the engineers' estimate of what outside service and heating would cost. We saved $14,000 as compared with the engineers' estimate of what the operation of an isolated plant would cost. We saved at least 800 ft. of space in the basement. We saved the operating expense of keeping the basement cool in summer. We saved the use of coal, or steam, for six months of the year. We avoided the nuisance of taking in coal and taking out ashes, and we saved the cost of breakdown connections." The consumption of energy for newspaper uses by the journal appears to run about 200,000 kw-hours per year. He gives the cost of energy as 2 cents per 1,000 sheets of 8 pages. The lighting is done by 2,956 incandescent lamps of 16-cp equivalent, and includes Nernsts and 44 Cooper Hewitt mercury vapor tubes. One of the electric elevators has the highest rise in the world—326 ft.—and has traveled 42 miles a day.

COLLEGE SUMMER SCHOOLS.—Mr. A. G. Mayer, in a letter to *Science,* protests against the establishment of summer schools by colleges. Among the objections urged are that formerly the college teacher looked upon his summer vacation as a season for research and broadening study, and that now fully one-half of this once cherished period must be sacrificed to the labor of dissemination of superficial and elementary instruction in summer schools. The development of the summer school in connection with the college is, he said, surely cutting down the precious hours when the teacher himself becomes a student. Correlated with the growth of the summer school system is the tendency of the college to maintain low salaries for instructors, relying upon the fact that by teaching in the summer school the young instructor may earn sufficient for his maintenance. Mr. Mayer states that in his official connection with the Marine Laboratory of the Carnegie Institute, whose purpose it is to afford unrivalled facilities for research to those best fitted to avail themselves of the opportunity, he finds that fully one-half of the ablest investigators feel obliged to decline invitations to pursue research work free of all expense, for the reason that in order to provide adequate support for a wife and family they must teach in the summer schools. Mr. Mayer concludes that not the least of the evil is the fact that our colleges are putting into the high place the ideal of mere money getting.

A WIRELESS CONGRESS.—It is announced in a special dispatch from Berlin that Germany has issued invitations to 29 States to take part in an international wireless telegraph conference at Berlin June 28. Among those invited in the Western Hemisphere besides the United States are Argentina, Brazil, Chile, Mexico, Peru and Uruguay, and among the European States are included Monaco and Montenegro. Japan, Siam and Persia have been invited, but China has not been asked to send representatives.

THE MEN OF '88.—A reunion of the foremen, assistants and electricians of the Thomson-Houston Electric Company of 1888 was held at the Revere House, Boston, on April 28. Eighty-three persons were formerly eligible, but 11 have died, leaving 72. Of these 29 are still at the Lynn factory, 11 at Schenectady, one at Harrison, N. J.; one at the Canadian General Electric Company and 30 have left the company. Forty-two were present at the exercises. The committee of arrangements were George H. Alton, Ambrose H. Sarsley and A. L. Rohrer. W. C. Fish was the special guest of the occasion. During the afternoon there was an automobile trip through Lynn, Nahant and Swampscott and lunch was had at the house of Prof. Elihu Thomson. At the banquet at the Revere House A. L. Rohrer officiated as toastmaster, and there were remarks by the toastmaster, Prof. Thomson, E. W. Rice, W. C. Fish, I. F. Baker and others.

THE TELEPHONE IN EUROPE.—In discussing the limited development of telephony in Europe, the London *Times* says: "The reason for the wide gulf between the position of the telephone service in America and that which it occupies in Europe lies in the difference of the attitude of the public—and of the representatives of the public—of the two continents toward the telephone service. In America the telephone service has been treated as a friend, or as a promising youngster capable of effecting vast improvement in the conduct of affairs. The American public, although occasionally it has grumbled about prices, has in the main always been willing to pay for efficiency. In Europe the telephone service has never been treated as a legitimate business enterprise and has never had a fair field. From the very beginning it has been treated as a mere offshoot of the telegraph, and it has occupied the position of Cinderella in the family of methods of communication placed under government control. As a result, not only have all sorts of harrassing restrictions inseparable from bureaucratic control been brought to bear, but telephony as a science, telephone engineering as a specialty, and telephone administration as a distinct branch of organized effort have been neglected."

AUTOMATIC TELEPHONY.—Mr. M. W. Littleton, counsel for the Atlantic Telephone Company, seeking a franchise and entrance into New York City, said in a recent interview: "Much has been said about the disadvantages of having two telephone systems in operation in the city, but there are a few phases of the situation that have been overlooked by the public. In the first place, the Atlantic Company is seeking entrance into an almost virgin field. Strange as it may seem to many, only 5 per cent of the residence of this city have telephones in their homes, and only 20 per cent of the business houses have telephone connections. Of course it is true that the business houses comprising this 20 per cent are the important concerns in the city's life, but it is nevertheless true that 80 per cent of the merchants and business houses here are without telephones because they are unable to stand the expense that the service would entail. Our company would offer service to 95 per cent of the residents and 80 per cent of the business concerns at rates within their reach and without entering, strictly speaking, into the field occupied by the New York Telephone Company. The majority of the business concerns using telephones of the existing company would of course be compelled to install our telephones in addition, but the number of persons they would be able to reach through our telephones would be sufficient to make it a paying investment for them."

Mr. A. S. Richey.

Albert Sutton Richey was born in Muncie, Indiana, on April 10, 1874. After graduating from the Muncie High School in 1890, he took up the electrical engineering course at Purdue University, from which he was graduated in 1894, the subject of his Purdue graduating thesis being "The Use of Storage Batteries in Electric Railway Power Stations." He was elected to the honorary society of Tau Beta Phi before graduation.

After leaving Purdue, Mr. Richey assisted in the installation of electric lighting plants in several small towns in Indiana and Illinois, and in January, 1896, entered the employ of the Citizens' Street Railway, at Muncie, Ind. In 1898 he was made chief electrician of this company, having in charge the mechanical and electrical equipment. In April, 1899, he went to Marion, Ind., as chief electrician of the Marion City Railway Company, and this company being absorbed by the Union Traction Company of Indiana, he was made chief electrician of the latter company in September, 1899. This company during the following year built its main power station at Anderson, and replaced its various direct-current power stations by rotary-converter sub-

MR. A. S. RICHEY.

stations, and during this work, Mr. Richey took charge of the rebuilding of the old overhead lines for the accommodation of the high-tension circuits, and also of the building of the new lines and sub-stations. In March, 1901, he was made electrical engineer of the Union Traction Company of Indiana, and given charge of the operation of the power station, sub-stations and electrical lines, as well as the design and superintendence of these parts of new construction and reconstruction.

As electrical engineer of the Indianapolis Northern Traction Company, Mr. Richey had charge of the design and construction of the doubling of the capacity of the Anderson power station and of the overhead lines and six sub-stations, located on the 150 miles of 30,000-volt transmission lines of this company. After the completion of the construction of the Indianapolis Northern Traction Company, this company was merged with the Union Traction Company of Indiana, these properties being leased by the Indiana Union Traction Company. Mr. Richey was made electrical engineer of the new company, and, in January, 1905, was made chief engineer, having in charge the design, construction, maintenance and operation of the entire power equipment and track and roadway.

In October, 1905, Mr. Richey resigned his position with the Indiana Union Traction Company, in order to accept the position of Assistant Professor of Electric Railway Engineering at the Worcester Polytechnic Institute, and is at present engaged in the development of the Electric Railway Engineering courses and the design of equipment for the Electric Railway Laboratory, which is to be a part of the new Electrical Engineering Building which the Institute is now erecting. Professor Richey is a full member of the American Institute of Electrical Engineers.

A Japanese Steam Turbine Electric Station.

THE Osaka Electric Light Company, of Osaka, Japan, presents an interesting example of electrical development which has taken place there in the past ten years. Organized in 1888, with a capital of 400,000 yen (about $200,000), this company has expanded until its present capital is nearly a million and a half dollars. A still further increase in capital is about to be made, so that with its larger plans the company will represent an investment of nearly two and a half million of dollars.

This growth is represented by four separate generating stations located at distributing points in the city, corresponding to wards in American nomenclature, and called respectively, the Nishidontonbori, Nakanoshima, Saiwaicho and Honden stations. The electrical equipment of the stations mentioned indicates the progressiveness of the Japanese engineers in following modern engineering practice, for the design of the stations is carefully worked out and the latest methods and most improved machinery are embodied in the generating plants. Both reciprocating engine and steam turbo-units have been installed; the latter type of prime-mover being a part of the more recent additions to equipment.

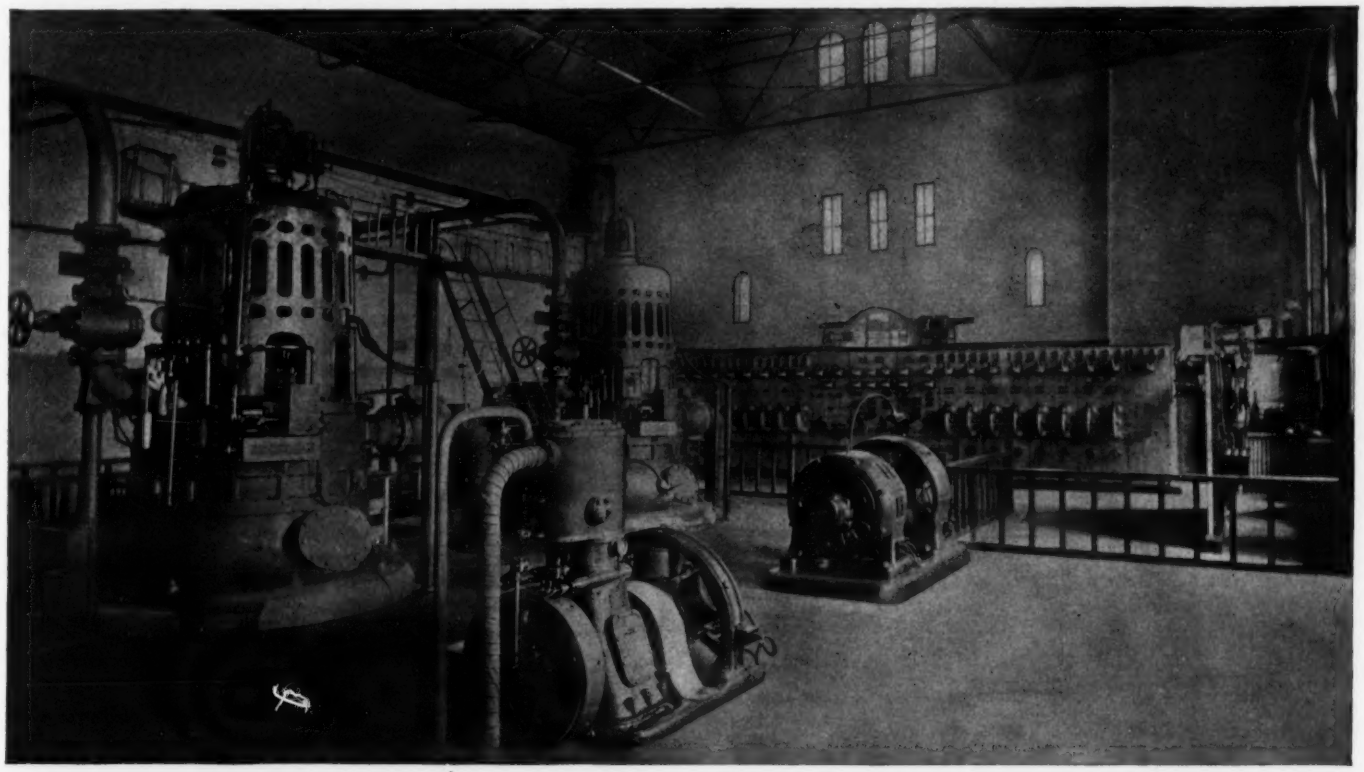


FIG. 1.—VIEW OF INTERIOR OF OSAKA, JAPAN, ELECTRIC LIGHT PLANT.

At the Nishidontonbori station the principal apparatus consists of two 500-kw, 2,300-volt, 60-cycle, two-phase Curtis turbo-generating units, a 150-kw, 2,300-volt, three-phase, engine-driven generator, and a 90-kw, single-phase generator operating at the same potential. The exciting current for the main generators is furnished by two 25-kw, 125-volt marine type generating sets driven at 450 r.p.m. by compound engines. In the second station, the Nakanoshima, there is a varied equipment. The principal apparatus consists of four monocyclic generators, one of 150 kw capacity, and three 120-kw machines. There are in addition three 75-kw, single-phase generators, and three 75-kw, Brush arc machines, each of which will supply current to 45 lamps. The Saiwaicho station also contains monocyclic machines as well as single, two and three-phase apparatus. There are five 150-kw, monocyclic generators, three 120-kw, single-phase and one 150-kw, two-phase generators, engine-driven. The largest unit in the station is a 1,000-kw, 2,300-volt, 60-cycle, two-phase Curtis turbo-generator with the customary exciting sets. These latter consist of two 25-kw, 125-volt marine units with compound vertical engines. All of the electrical equipment in the three forego stations was manufactured by the General Electric Company.

The Honden station may be taken as a type of these stations and also representative of the more modern Japanese power plant design. The interior arrangement of this station is shown in Figs. 1 and 2. The power house is constructed of reinforced concrete with trussed steel floor. The entire floor of the station is served by a 20-ton crane running the length of the building. As can be seen in the photograph, the natural lighting is excellent and the principal artificial illumination is secured by arc lamps swung out from the wall to secure even distribution of light. Portions of the machinery are individually lighted by incandescent lamps so that the attendant can work to the best advantage. All station wiring, with the exception of the necessary lighting circuits, is laid below the floor, so that the station presents a neat and spacious appearance. The compactness and business-like aspect of the vertical turbines adds greatly to this general effect.

The station proper is divided into two sections, the boilers being separated from the generating room by a partition through which connection is made with engines and turbines, on the opposite side, by short lengths of steam piping, thus doing away as far as possible with condensation losses. At one end of the generating room are two 600-kw, two-phase, 60-cycle, 2,300-volt generators direct-connected to McIntosh & Seymour engines with the exciting units as shown in Fig. 2. Each engine is a horizontal cross-compound, condensing machine, the cylinders being 22 in. and 46 in. in diameter, respectively, with 36-in. stroke. Each is rated at 900 hp at 120 r.p.m. The cylinders are equipped with tail rods, the pistons being thus supported between two crossheads and relieving the cylinder walls from the weight of the pistons. In this way the cylinder wear is decreased and the life of the engine lengthened. The engines are also equipped with electrically-operated speed changing and synchronizing devices.

Two Curtis steam turbine units are grouped with their exciters at the other end of the building. Each unit consists of a 500-kw, 2,300-volt, 1,800-r.p.m., 60-cycle, three-phase generator mounted vertically on the same shaft with the turbine. For field excitation of the turbines a duplicate direct-current generator equipment is provided; one a steam, the other an induction motor-driven set. The steam set comprises a 25-kw marine engine unit, the engine being of the cross-compound type. The motor-driven set is a similar generator driven by a 40-hp induction motor.

Across the end of the station is the main distributing switchboard shown in Fig. 1. This main board is made up of twelve panels constructed of blue Vermont marble and equipped with the necessary instruments and switches. There are eight distributing or feeder panels, two generator panels, one exciter panel and one induction motor panel.

The turbine switchboard is located at right angles to the main board, as seen in Fig. 1. The board is constructed of blue marble and consists of eight panels, including a 30-kw exciter panel, two 500-kw generator panels for governing the turbines, and five three-phase, 2,300-volt feeder panels. The switchboard is very completely equipped with instruments and oil type switches, including synchroscope and polyphase ground detector on a swinging bracket, and electrically-tripped oil switches.

Current from the various stations is used principally for lamps, although a few motors are in use. There are at present about 85,000 lamps in circuit, 90 per cent of the electricity for lighting being sold to customers under the contract system and not by meter. As is customary in Japan, all wires within the city limits

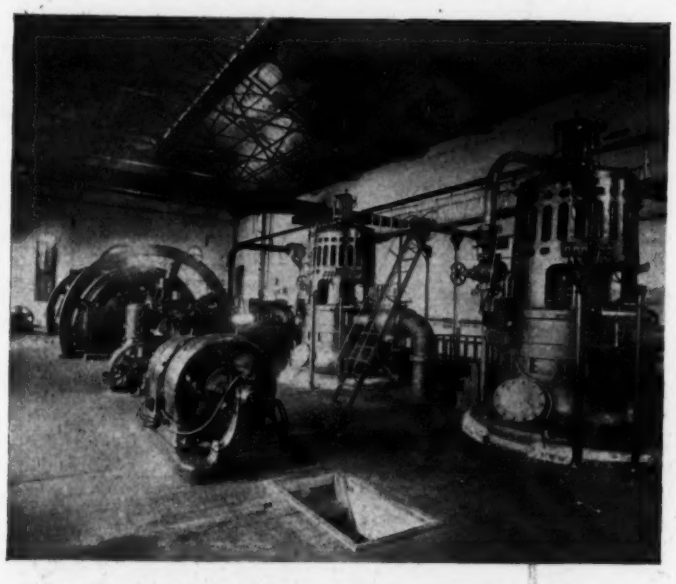


FIG. 2.—TURBO-GENERATORS AND EXCITERS, OSAKA.

are laid underground. In this respect the practice in Japan is far ahead of that in the United States. Government inspection and supervision of all electrical work, whether of a public or private character, tends to insure a high standard in all electrical construction and operation, and renders Japanese cities free from the tangles of unsightly wires so noticeable in many American cities. Government control also regulates the use of ground circuits. These regulations require a complete insulated circuit on trolley lines within the city limits, and all Japanese cars within the city have, therefore, a double trolley line with no ground return.

In the preceding description an idea has been gained of the present equipment of the Osaka Lighting Company, but the company is planning for a large extension in the immediate future. The city of Osaka with the nearby suburb of Sakan and vicinity, has a population of about 1,000,000. That this population is rapidly taking advantage of the convenience of electric service as extended to them by the Osaka Lighting Company, is shown by the fact that the company finds it necessary to build another central station with a capacity sufficient to operate 300,000 16-cp lamps. The 1,000-kw steam turbines of the Curtis type have already been ordered for this purpose.

The design and execution of the plans for the electric plants have been most successfully carried out by the company's engineers, under the direction of Mr. T. Ikeda, chief electrical engineer, assisted by Mr. K. Kimura, Mr. S. Kitaura and Mr. W. Minomuro, without any assistance whatsoever from foreign engineers. The organization of this progressive eastern lighting company is as follows: Mr. M. Doi, president; Mr. S. Akizuki, managing director; Mr. K. Noda, Mr. T. Kameoka, Mr. S. Fujimoto, directors, and Mr. B. Oi, auditor.

Another Tungsten Filament Lamp.

According to our London contemporary, *The Electrician*, another tungsten filament lamp will soon be exploited in Europe. This lamp is distinct from the one being developed by Dr. Kuzel, of Vienna, references to which have recently appeared in these columns, and the term wolfram seems to be applied to it by its inventors instead of the synonym tungsten. An English patent (No. 11,949 of 1905) has been granted on this lamp to Dr. Alexander Just and Frank Hanaman, of the Vereinigte Elektricitäts Werke, of Budapest, and the German rights have been acquired by the Wolfram Lampen Actiengesellschaft, of Augsburg. The following particulars of the process of manufacture are from the British patent:

"Experiments, it is said, have demonstrated that when carbon filaments, which are provided with coats of wolfram (tungsten) or molybdenum of sufficient thickness, are submitted in highly rarefied gases or in vacuo, in order to prevent oxidation of the metal under the action of the electric current, to an adequate temperature, the carbon combines with the metal surrounding it with the formation of a carbide. The carbon becomes completely dissolved in the metal in such a manner that a filament formed in accordance with this process is entirely homogeneous, so that under the microscope no carbon core can be distinguished at the point of fracture. This process, which may be termed 'dissolving' the carbon, occupies but a few minutes, and takes place the more speedily the greater the excess of metal above the carbon.

"Carbon filaments of the greatest possible fineness (of a diameter of, say, from 0.02 mm. to 0.06 mm.) are submitted to the action of an electric current in an atmosphere of chlorides of wolfram or molybdenum (preferably WCl_6 = wolfram hexachloride, or molybdenum pentachloride = $MoCl_5$) in the presence of hydrogen or of some other gas exercising a reducing action, whereby the wolfram or the molybdenum is metallically deposited upon the surface of the carbon. When the metallic coating is of sufficient thickness, which may be ascertained by the current indicated by an ammeter (say 1 amp. when carbons of 0.04 mm. diameter are employed), the filaments are brought to incandescence by an electric current in an atmosphere of very highly rarefied inert gases, such for example as hydrogen gas at a pressure of 20 mm. The solvent process referred to above then takes place in a very brief period, a few minutes being usually sufficient. The filaments so obtained, which contain the carbon in a bound form (mostly as carbide) present a glittering white metallic appearance.

"The incandescing filament is once more raised to a high temperature by an electric current in a mixture of steam with reducing gases, and the carbon is oxidized by a similar action to that which takes place in the manufacture of water gas. An alternative method given for the elimination of the carbon is to raise the incandescing filament to a high temperature in vacuo by the electric current for a long time (say 24 hours) in such a manner that the carbon volatilizes. Another method of decarbonizing described is as follows: The metal filaments containing carbide are embedded in a refractory crucible, which is then carefully luted, in very finely pulverized low oxides of these metals, such for example as WO_2 or MoO_2, which is then submitted to the heat of a blast furnace (about 1,600° C. are required) for several hours. By this process the carbon is oxidized as indicated in the following equations: (1) $WO_2 + 2C = 2CO + W$; (2) $MoO_2 + 2C = 2CO + Mo$. The reduced wolfram or molybdenum does not become deposited upon the filament, but remains comprised in the oxide mass, because the wolfram or molybdenum upon reduction at this temperature surrounds the filament as an amorphous powder, without being deposited upon the same. As soon as this oxidation process is completed (in, say, from 10 to 12 hours) cooling is allowed to take place, and the crucible is opened."

The metallic filaments obtained by one of these processes may then, it is stated, be fused into the glass bulbs and employed for incandescent lamps without further treatment.

Residence Lighting and Other Central Station Work at Wabash, Ind.

ONE of the most notable things about the business of the Wabash Water & Light Company, of Wabash, Ind., is the large proportion of residence lighting. This is due partly to the fact that the management has realized the importance of residence lighting load and has taken pains to develop it, and partly because the gas business in Wabash has always been in an unsatisfactory state. Attention has frequently been called of late in these columns to the importance of residence lighting business as a revenue producer. It has been pointed out that the trouble with residence lighting in the past in many cases has been that central stations have not secured a sufficient quantity of it. At Wabash the company is doing residence business on a scale which makes it profitable.

Wabash has a population of about 9,000 and the number of residence customers is about 600 out of a total of about 800. The company does most of the wiring that is done in the town at cost, employing first-class wiremen. This avoids dissatisfaction with poor wiring by irresponsible wiring contractors. By this means the company is able to see that customers are equipped properly to get all the advantages of electric service and to get the best illumination possible for their money. The company's best wiremen are educated from the ranks of good mechanics, as a good workman in one mechanical trade will usually make a good workman in another.

RESIDENCE DISTRIBUTION.

The principal residence districts have secondary mains running through them which are continuous for blocks, transformers being located about one to each block. Very neat pole line construction with Idaho cedar poles is employed in the residence districts, as can be seen from an inspection of Figs. 1, 2 and 3. Figs. 1 and 2 show a pole line of very high poles running up one of the principal streets. As shown in Fig. 2, transformers are mounted

FIG. 1.—HIGH POLE LINE ON RESIDENCE STREET.

about half-way up the pole, thus obviating hoisting the transformer to the top of the pole and also making it possible to replace transformer fuses without going up among the live wires. On some parts of the street shown in Figs. 1 and 2 there are shade trees, the tops of which reach almost to the line wires.

TREE TRIMMING.

A method of tree trimming has been adopted which disfigures the trees but little and insures wires being kept fom the branches. A cable is stretched between poles and a lineman is sent out on a traveler hanging from this cable. He can then trim the trees just at the places necessary to keep them from the wires, while when the lineman must climb a tree and do his cutting where the branches are heavy the reverse is apt to be the case. Fig. 3 shows the construction in alleys and gives an idea of the number of service wires running to residences. On these short poles

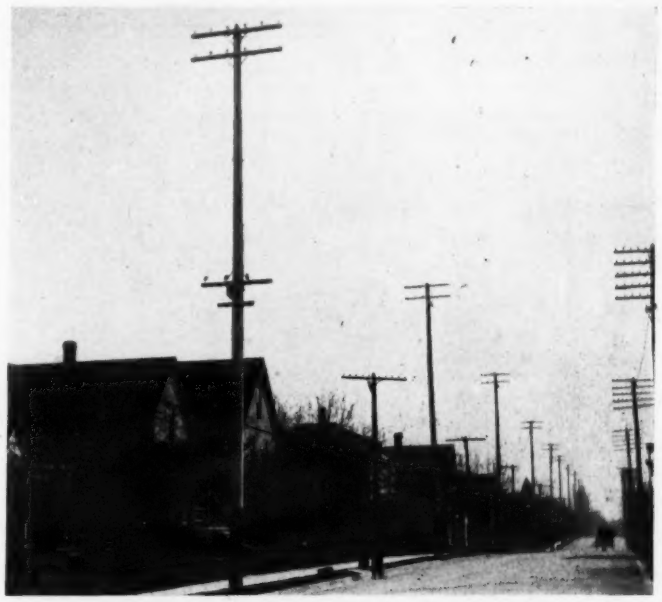


FIG. 2.—SHOWING LARGE PERCENTAGE OF RESIDENCES CONNECTED ON A WABASH STREET.

the transformers are placed at the top. Branch lines of the primary circuit are fused with enclosed fuses.

RESIDENCE RATES.

The rates for residence lighting are 12 cents per kw-hour up to 30 kw-hours' consumption per month. Where a customer's consumption is over 30 kw-hours per month, the rate is 10 cents per kw-hour. This would make the customer's bill less for a consumption between 25 and 30 kw-hours per month than for a consumption of 30 to 36 kw-hours per month. To provide partially against this discrepancy the consumption between 28 and 30

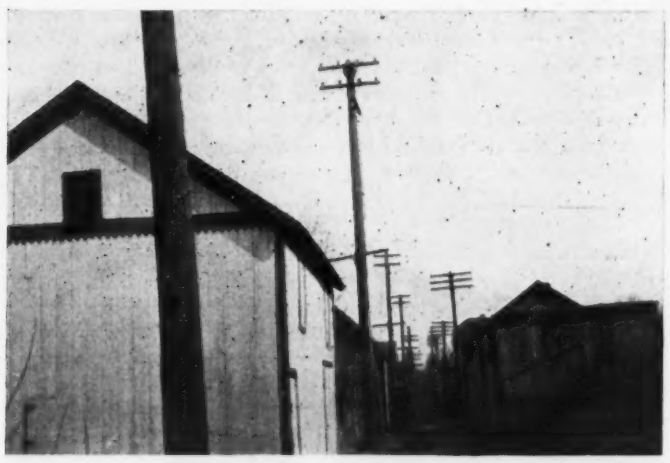


FIG. 3.—ALLEY POLE LINE CONSTRUCTION.

is figured at a lower rate than 12 cents. The minimum bill is $1.25 per month.

YEARLY RESIDENCE CONTRACT.

A somewhat unusual contract is offered to customers in this connection. A residence owner can pay $15 per year in advance, or in other words, the amount of his minimum monthly bills. He will then be billed yearly for all energy consumed in excess of a value of $15. This, it will be seen, gives the customer the advantage of some saving because in many cases during the sum-

mer his consumption will be less than the minimum bill, while in the winter it will be considerably more. Under a monthly payment plan he never pays less than $1.25 per month, and in the winter he will usually pay considerably more. Under the yearly payment plan it is possible to bring the average payment per month down almost to $1.25 if the consumption is small. This plan proves popular.

PARK LIGHTING.

Besides residence lighting the company has, during the summer,

FIG. 4.—PARK WIRING.

a very desirable class of lighting on its residence circuits, namely, that of a city park, which contains 200 Meridian lamps, each of 125 watts. Fig. 4 is a winter view taken in this park, showing the way the wires are run and supported on unobtrusive brackets from the trees. The lamps are screwed in water-proof sockets, these sockets being connected between the outer and neutral wires of three-wire secondary mains running through the park. As this park lighting is done in summer when there is little commercial lighting, it is a most desirable class of business. This park occupies an area equal to about two city blocks.

WELL-LIGHTED CHURCH.

A fine example of good illuminating engineering on the part of the company is to be found in a large church recently wired. The church had been previously lighted with large gas chandeliers which were exceedingly trying on the eyes. The company was given a free hand in designing the electric lighting. The principal illumination is secured by small clusters of Meridian lamps with sockets pointing straight downward and placed high up on beams which form a part of the roof architecture. The

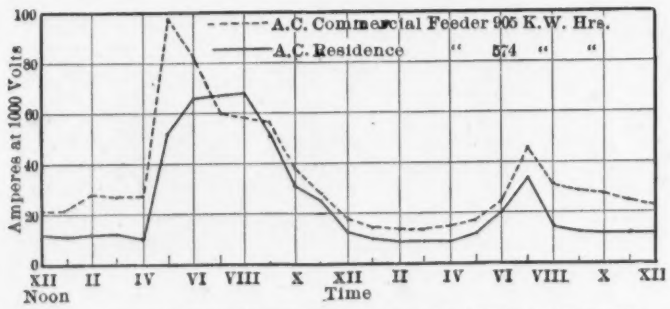


FIG. 5.—COMPARISON OF RESIDENCE AND COMMERCIAL LIGHTING.

reflectors on these lamps throw the light downward where it is needed, and their frosted bulbs as well as the fact that but few lamps are placed in a cluster, make the lighting arrangement easy on the eyes. To bring up the illumination around the sides, upright wall brackets were used with open shades of a type which diffuses the light and distributes it principally at angles below the horizontal. The intensity of the light is sufficiently reduced by the globes on these side wall brackets to have a minimum tiring effect on the eyes. Lamps placed low around the pulpit and organ have been avoided as not only detracting from the general effect, but as being trying to look at through an evening service. The illumination of the choir and organ is obtained from Meridian lamps placed high up as in other parts of the church. For pulpit lighting a lamp of the bunghole type is placed close down to the surface of the pulpit with a shade fitting closely over it so that the light shines only on the surface of the pulpit, the angle being such that there is practically no glaring reflection of the light from the smooth surface of a book or paper on the pulpit.

LOAD CURVES ON RESIDENCE AND OTHER BUSINESS.

In order to show the relative importance of residence lighting to other lighting in Wabash, a curve has been plotted, Fig. 5,

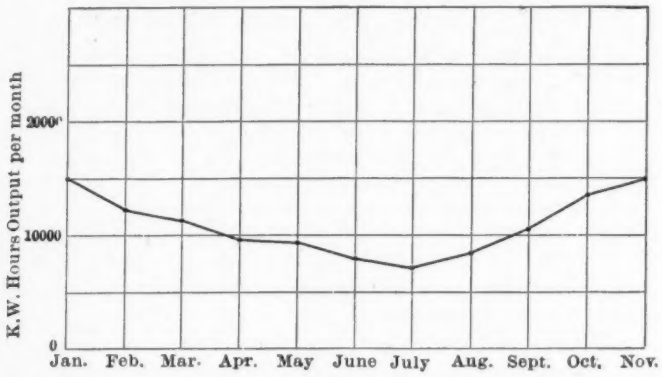


FIG. 6.—ENERGY OUTPUT PER MONTH ON ALTERNATING-CURRENT CIRCUITS.

the solid line of which shows the load in amperes on a feeder supplying residence lighting almost entirely, and the dotted line the load on a commercial lighting feeder, from noon, January 3, to noon, January 4. The voltage is 1,000. The total output on the residence feeder for that 24 hours was 574 kw-hours. On the commercial lighting feeder the output was 905 kw-hours. The load factor is much the best on the residence feeder. Fig. 6 shows the kilowatt output by months on the residence feeder. It should be explained that the company's motor load is only by 500-volt direct-current service, so that the outputs given represent lighting almost entirely.

The electrical output of the company's plant for the same day January 3 to 4, 1906, for all circuits was as follows:

Series incandescent lighting	224 kw-hours
Alternating current residence lighting	574 kw-hours
Alternating current commercial lighting	905 kw-hours
500-volt motor load	300 kw-hours
Direct current series street arcs	471 kw-hours
Total	2,474 kw-hours

The influence of stores being kept open Saturday evening instead of closing at 6 o'clock as usual is shown by the curve, Fig.

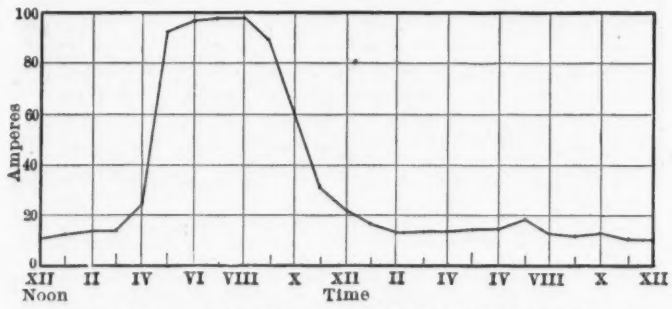


FIG. 7.—LOAD ON COMMERCIAL ALTERNATING-CURRENT CIRCUIT.

7, giving the load in amperes on the commercial alternating-current circuit for 24 hours beginning at noon on January 6, 1906.

ELECTRIC FLATIRON BUSINESS.

The company has between 30 and 40 electric flatirons in use by its customers. It is the intention to push this business actively and put irons out on 30 days' trial. The iron which the company is now purchasing and putting out on trial is the Pacific, made in Los Angeles, and was selected on account of its ease of

repair and the fact that it is provided with an inexpensive inverted holder so that the iron can be used for light cooking.

OFFICES AND ATTENTION TO BUSINESS.

One very creditable thing about the company's business methods is the excellent attitude maintained by clerks in the office toward the public. It is sometimes the case that clerks who are constantly meeting the public at the window of a public service co-

REPORT OF TEST

Meter No. Our No. Capacity
Make ½ Wire Constant
Dial Reading at Beginning of Test
" " " Close "
One Light—Actual Watts Ind. Watts
¼ Load— " " " "
½ Load— " " " "
Full " — " " " "
Error 1 Lt. % Fast Slow ¼ Load % Fast Slow
" ½ Load % Fast Slow Full " % Fast Slow
Meter Test in
Date
Inspector

FIG. 8.—CARD FOR REPORT OF METER TEST.

operation's office get unconsciously into the habit of being indifferent or rude. This may be partially brought on by listening to unreasonable complaints. However this may be, the complainer in most cases believes he has a cause of grievance. To handle all customers courteously and have them leave the office feeling better than when they came in is indeed a fine art, but it has been well developed in the Wabash Water & Light office.

The company has an office on one of the principal business streets and maintains an attractive show window. At the time of the visit of the writer, this show window was fitted up with a pair of small dark rooms with sides open toward the street for the purpose of showing the comparative value of different reflectors. Samples of heating devices are kept in the rear of the manager's and bookkeeper's office. Back of this is the store and repair room.

SIGN LIGHTING AND FREE SIGNS.

The sign business has been little developed, but an active sign lighting campaign is to be begun, probably under a form

METER

Our No. Makers No.
Make Type
Capacity Voltage
Constant Alternations
Date Installed
Date Removed
Last Test No.

FIG. 9.—OFFICE RECORD OF METERS.

of contract whereby the company will furnish signs free, renting and maintaining them on a two-year contract at a price sufficient to pay for the kw-hours consumed and the sign.

METER TESTING AND CARD RECORDS.

The company has about 800 meters. The Westinghouse meter is now the standard used. These meters are taken care of and read by one meterman, who brings in each meter for test once a year. Fig. 8 is a reproduction of the 4 by 6-in. card used in reporting tests on meters. The test number is placed at the top right-hand corner. In connection with this another meter card is used (Fig. 9), the latter card giving an office record of the meters owned by the company. The test number on the latter card refers to the test card (Fig. 8). With the meter card (Fig. 9) is kept a customer's card (Fig. 10), on which is

Consumer
Street
Owned by
House Wired 2-3 Wire or Convertible
House Connected to Transformer station No.
" " " Secondary Main No.
Date Turned on Date Turned off

LOAD

32 C. P Lamps Arc Lamps
16 C. P. " Fan Motors
8 C. P. " Other
4 C. P " Total Load in 16 C. P
2 C. P. " Equivalent

FIG. 10.—CUSTOMER'S METER CARD.

kept a record of each customer, his installation and to what transformers and mains the meters are connected.

POWER STATION.

The power plant is a combined water pumping and electric light station. The engines are all belted to a line shaft from which generators and water works pumps are belted. The engines are of the Corliss type. There are two water-tube and two shell-type boilers. The whole output of the station is measused by meter, electric meters being placed on the switchboard for each class of service and water meters being used.

MEASUREMENT OF HOT WATER.

The water supplied to the boilers has been heretofore measured by meter, but on account of the well-known unreliability of hot water meters a new plan is about to be tried. The feed water pump is of the outside packed plunger type. A small pump which has a capacity exactly 1/10 that of the feed water pump is to be connected directly to it so that each stroke of the feed water pump will operate the small pump. This small pump will pump water into a tank with but little head and the amount of water pumped into this tank multiplied by 10 will be assumed to give the amount of water pumped by the large pump.

The evaporation of water per pound of coal is watched very closely as there is considerable difference in different veins of the Indiana coal used. The average evaporation is 7⅓ lb. of water per pound of coal. On account of water pumping and dynamo driving being done from the same shaft, the kw-hours per pound of coal cannot be determined. Boilers are cut in and out according to the load on the station, as this is found more economical than running boilers with a slow fire. The power house operating force consists of two engineers, one fireman and one coal passer in the daytime, and one engineer, two firemen and one coal passer at night. The reason for two engineers in the daytime is that repairs are made then. The power station is in charge of Mr. O. H. Young, chief engineer.

MOTOR BUSINESS.

The relative amount of motor business done by the company has been already noted. Motor rates are as follows:

0 to 187½ kw per month.....4½ cts. per kw-hour
187½ to 375 kw per month.....4 cts. per kw-hour
375 to 750 kw per month.....3½ cts. kw-hour
750 to 1,875 kw per month.....3½ cts. kw-hour
1,875 and up kw per month.....3 cts. kw-hour

No motor bill is made for less than $2.00 per month.

WHISTLE CALLS.

A very useful wrinkle in the company's practice is that of having a system of power house whistle signals for the officers

and principal employes of the company. By telephoning the power house almost anyone connected with the company within hearing of the power house whistle can be notified to call up the general offices by telephone at once. In this way the manager and men can be brought into quick communication at any hour of the day or night when they cannot be reached otherwise.

The company is under the management of Mr. T. W. McNamee.

Electrical Engineering at Cornell.

Electrical engineering has been taught at Cornell University as a sub-division of mechanical engineering for twenty years, or since the accession of the late Prof. Robert H. Thurston to the directorship of Sibley College in 1885. The foundation of this work was laid by Prof. Wm. A. Anthony, who has always been keenly alive to see and utilize advances in the science of physics. He had been interested in the applications of electricity in connection with his courses at Cornell and as soon as the state of the art warranted he established, in 1883, a course in Applied Electricity. This was naturally a scientific course, and led to the degree of B.S. in electrical engineering. Four men were granted this degree in 1885, and two more degrees were conferred in 1886, by which time the engineering course had become well established.

Although not an undergraduate, Mr. James G. White did a great deal of work in the electrical engineering department during

FIG. I.—APPARATUS ARRANGED FOR EXERCISE IN CONNECTING ELECTRIC RAILWAY EQUIPMENTS.

these pioneer years, receiving the degree of Ph.D. in 1885. Three men received the degree of M.E. in electrical engineering in 1886, one being Prof. Ernest Merritt, now a distinguished physicist. Another was Mr. George B. Dusinbere, manager of the Cleveland District of the Westinghouse Electric & Manufacturing Company. In the following year seven men completed the course, and among them was Prof. Harris J. Ryan, now of Stanford University, who afterward succeeded in developing the course to a remarkable degree, and who was head of the department from 1889 to 1905, a total of fifteen years. Prof. Dugald C. Jackson completed two years of graduate work in 1887. He had received the degree of B.S. from Pennsylvania State College in 1885, and was thus prepared to take immediate advantage of the course in electrical engineering.

Of the eight men graduating in 1888, several well-known names are found, including Edward Caldwell, manager of the book department, McGraw Publishing Company, and I. J. Macomber, of Westinghouse, Church, Kerr & Co. From this time on the classes became very large and included scores of men who are now leading in practical and scientific work and in electrical instruction. The numbers continued to increase until 1896 and 1897, when 69 graduated each year. After this a depression occurred, in common with all other schools, as was shown in the exhibit prepared by Prof. B. V. Swenson for the Land Grant College exhibit at the Louisiana Purchase Exposition. At the present time the rate of increase is again large, as is shown by the fact that last year 78 men completed the course and this year there will be 108. The latter figure is abnormally large and the indications are that the class of 1907 will not surpass the present class in size. These figures and the careers of the 786 men who have completed the course indicate the quality of the work done by Prof. Ryan in Cornell University.

Year.	M. E. Degrees Granted.	Graduates in E. E.	Per cent of Electrical Engineers.
1886	8	5*	62.5
1887	19	7	36.8
1888	22	8	36.4
1889	32	19	59.4
1890	54	28	51.9
1891	52	28	53.8
1892	85	44	51.8
1893	93	46	49.5
1894	81	43	53.1
1895	87	51	62.7
1896	110	69	62.7
1897	125	69	55.2
1898	87	46	52.9
1899	89	33	37.5
1900	100	43	43.0
1901	110	29	26.4
1902	110	36	32.7
1903	157	51	32.5
1904	140	53	37.8
1905	205	78†	38.1
Total	1,766	786	Average 44.5

* Includes two degrees of B. S. in E. E.
† Includes two graduates taking undergraduate work.

The accompanying table shows in detail the proportion of electrical engineers in each class, this proportion fluctuating between 26.4 per cent and 62.7 per cent, the average for twenty years being 44.5 per cent.

As is well known only one undergraduate degree is given in Sibley College, that is M.E. The fundamental features of all the courses in the college are the same, specialization occurring slightly in the junior year and more completely in the senior year, although, even in the latter, many courses are taken by all students. In the second half of the junior year the electrical engineers take a course of four recitations per week which prepares them for the analytical and practical study of electric circuits and machines, and which is continued through about one-half of their senior year. This amount of preparatory work will soon be increased to include elementary laboratory instruction. The plan of the senior year, as far as electrical instruction is concerned, consists of three essential divisions:

(*a*) Laboratory instruction in the characteristics of operation of electrical machines and other devices;

(*b*) Analytical study of methods for predicting machine performance;

(*c*) Graphical study connecting the work of the laboratory and the classroom.

The senior laboratory work consists of approximately 60 experiments arranged to illustrate the modern electrical applications, each experiment requiring three hours for its completion and from three to six hours for the preparation of a report. A recitation is held in advance of each two experiments in order to insure a proper experiment. A part of this recitation is written so as to insure an advance study of the assigned text prepared in the department. The laboratory is under the joint direction of the Department of Experimental Engineering, headed by Prof. Rolla C. Carpenter, and the Department of Electrical Engineering.

The analytical work is founded on the junior course and it is given by lectures and by the solution of practical problems. The modern theory of each type of machine is discussed and illustrated mathematically and graphically and the student is made acquainted with the appearance of machines of all sizes and makes. The lectures are merely instructions for solving problems which form the principal part of the work and upon which the student puts from six to ten hours per week. In this, as well as the laboratory course, the student is directed to the sources of correct information in the literature, and he is encouraged in every way to familiarize himself with the best books on engineering subjects and the best of the current technical papers.

The third phase of instruction, and the one which is in many ways most important is the drafting room course in which the theoretical and the practical instruction are blended. A certain amount of time is spent in the designing room, not for the purpose of producing original designs, but to plot curves from the laboratory data and to work analytical problems bearing on the same class of machines, so that the students will gain confidence in his theory and so that he will be able to fall back upon actual results when the theory apparently fails. All of this is done under

competent instruction and the results have been exceptionally satisfactory.

Up to the middle of the senior year the work deals largely with fundamentals, but after this a certain amount of time may be spent in advanced study of electrical applications. Among these are applied electricity in physics, electrochemistry, electric railways, telephone engineering, generation and distribution of electric energy and the design of electrical machinery. As the preparation of a thesis is optional, many seniors prefer to substitute an equivalent amount of time in these advanced electrical

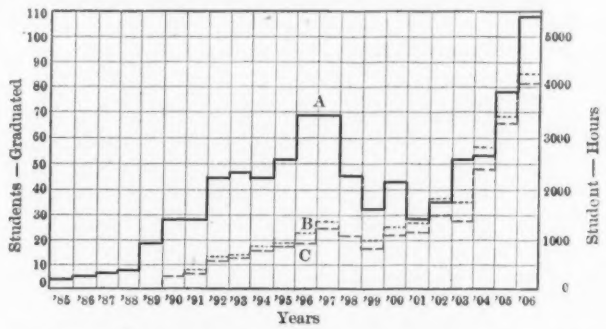


FIG. 2.—STUDENTS GRADUATED AND THE HOURS OF INSTRUCTION.

courses or in courses of a similar grade. Thus each student goes out with special preparation in some subjects. This preparation is not intended to make him an expert in any specialty, but it gives him an appreciation of the nature of the specialty and of the manner in which it is related to his fundamental studies.

It is interesting to note not only the increasing number of students in the technical schools, but also the amount of electrical instruction given to each. The accompanying diagram illustrates this growth. In this diagram the curve *A* represents the number

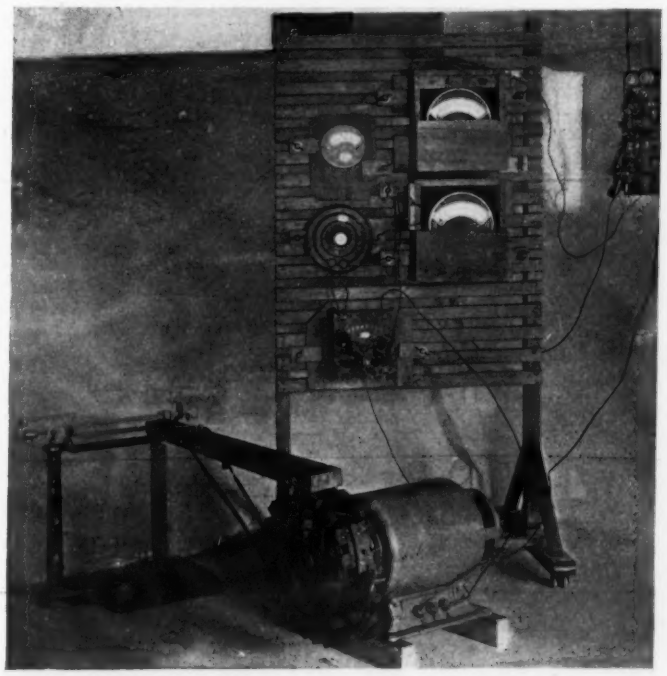


FIG. 3.—APPARATUS ARRANGED FOR MOTOR TEST.

graduated, *B* the hours of instruction in required and elective courses, and *C* the hours of instruction in required courses. The unit in which the amount of instruction is measured is the "student-hour," a term which requires some explanation. A university hour at Cornell is the amount of instruction for one-half year represented by one lecture or recitation per week or by two and one-half hours in a laboratory, shop or drafting room. Each course is rated at a certain number of hours per term and each student is expected to complete approximately eighteen of such hours per term. By reference to the chart it will be noted that the number of student-hours of instruction per student graduated in electrical engineering rose from nine in 1890 to forty-two in 1905. Not all of this instruction was given to electrical engineers, as in recent years the non-electrical engineers have in large numbers taken the elementary electrical courses. However, as an indication of the amount of work done by the department the comparison is fairly satisfactory. The corresponding figure for 1906 does not allow a similar comparison, from the fact that during this year the electrical laboratory work, formerly given by the Department of Physics has been transferred to Sibley College. Also during the present year for some unknown reason the number of seniors graduating in electrical engineering forms an unusually large proportion of the whole, and it is also large compared with the total amount of instruction given. The value of 39.4 student-hours per student graduating indicates that the junior classes are not as large proportionately as during last year. They are more nearly in line with the natural growth as indicated by the chart.

Sibley College has for a long time supported a successful electrical society managed entirely by the students. This society now meets once a month in comfortable quarters away from the college, and the members discuss general topics of interest to themselves. In some years lectures by faculty members and others were given, but the present plan is found to be much more satisfactory. There are also monthly meetings of the local branch of the A. I. E. E. which are largely attended, and these meetings are greatly enjoyed by the students, who thus come into touch with actual practice. There are always present students and teachers who have had actual experience with the subjects presented which enable them to contribute materially to the discussion. As the function of these meetings is more thoroughly understood, they have become less formal and more enjoyable, and they supplement the class instruction in a helpful manner. As in the case of the electrical society, the meetings are held away from the college in order to remove the classroom restraint which would otherwise be felt.

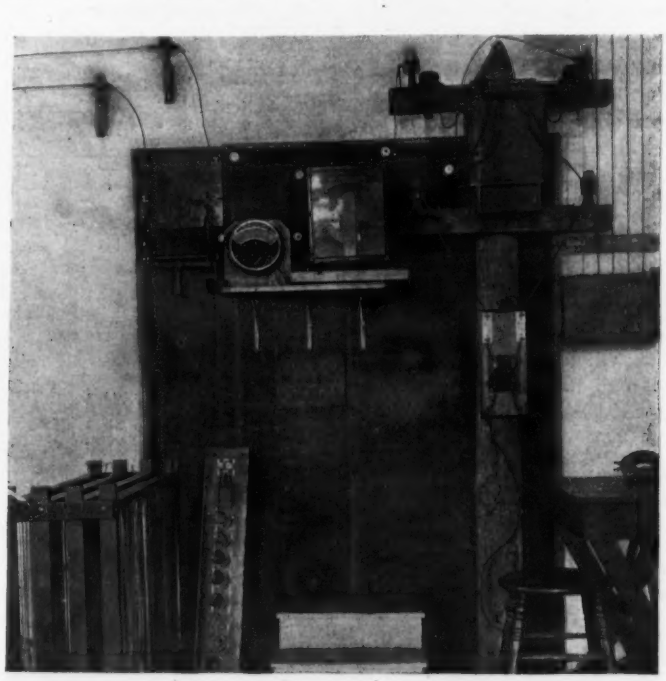


FIG. 4.—APPARATUS ARRANGED FOR TRANSFORMER TEST.

The Department of Electrical Engineering is in charge of Prof. H. H. Norris, who served as superintendent of the electric railway test commission, which conducted an exhaustive series of tests on railway equipments under service conditions during the Universal Exposition at St. Louis, Mo., in 1904. Prof. Norris was engaged as special expert in connection with the reorganization of the American Street Railway Association in 1905. The experimental work of the Department of Electrical Engineering is under the immediate direction of Assistant Professor V. Karapetoff.

The Depreciation of Electrical Properties.

Prof. G. W. Bissell, of Ames, Iowa, read a paper at the convention of the Iowa Electrical Association, Des Moines, April 19, 1906, on the above subject. The following were some of the points he brought out:

As a preliminary to the preparation of this paper, the writer sent to each member of the association a letter propounding and asking replies to the following inquiries:

1. In computing the total cost of your output, do you make allowance for depreciation?

2. If the answer to No. 1 is affirmative, how much depreciation do you charge off, and how do you arrive at this amount?

3. How do you invest your sinking fund?

Twenty replies were received. Three answered questions 1 and 3 in the negative without explanation or other sign of interest in the matter and they of course gave no answer to question 2.

Four members answered question No. 1 in the negative, but explained that circumstances, such as pressure for dividends, prevented the practice, or regretted that extensive renewals of deteriorated property had prevented, or that the plant was not yet old enough to be affected by depreciation; but all four evidently appreciated the importance of the subject.

Two members took issue against the recognition of depreciation as an account to be considered in making a true book showing of the property. Attention will be called to these arguments later.

One member answered question No. 1 in the affirmative and No. 3 in the negative and evidently confused depreciation and maintenance.

The remainder, ten in number, gave affirmative and more or less complete answers to the three inquiries, and quotations from the letters are here presented.

1. "We set aside about 5 per cent of gross investment each year for maintenance of property."

2. "We use the replacement value of the plant equipment as a base on which to figure depreciation. . . . The fund derived from these amounts is deposited in the bank as a time deposit and draws interest. It can only be withdrawn by consent of our board of directors. All amounts realized from sale of replaced machinery, scrap, wire or any part of our equipment, is credited to this account. Sinking fund is for bond redemption only."

3. "Upon the actual cost of our plant we figure a depreciation of 8 per cent and invest the amount where we can find and receive the best interest rate."

4. "Charges of 8 per cent annually, investing not to exceed one-half in improvements and the balance in the bank at 4 per cent per annum for replacements."

5. "We figure 6 per cent for depreciation in computing the cost of energy, but have never been able to create a sinking fund to take care of the item. We consider 6 per cent a low figure."

6. "We charge 5 per cent of our total investment each year for depreciation. Ten years' experience shows that this is not enough, and hereafter the charge will be 7 per cent.

"Depreciation is the one thing that makes electric lighting in a small town a poor business."

7. "As a rule electric installation is without sufficient capital. They soon find themselves face to face with the proposition of providing for their extensions and depreciation, and at the same time meet the expectations of the stockholders for dividends. It has been our custom to put sufficient money into the plant each year in the way of repairs to maintain its value. The objection to this plan of providing for depreciation is that it is not uniform. One year we have little or no repairs, while next year the repairs are excessive.

"In the present state of the business I should think a fair allowance for depreciation would be from eight to ten per cent on the cost of construction. While it is true that electric apparatus as built to-day perhaps has a life of more than ten years, still in the readjustment of things occasioned by the growth and development of the business and the growth and development of appliances, our past experience will indicate that we will rarely ever use a piece of machinery more than ten years.

"We believe that a fixed per cent on original cost should be placed in the sinking fund each year to provide for depreciation, and that this sinking fund should be invested to the best possible advantage; but we think you will find very few companies in this State providing a sinking fund.

"It is not wise for a manager to overlook this item because it is something that must be provided for, and while he may be able to evade it for a few years, it will finally present itself in an aggravated form and there is no escape."

8. "We had no bonded indebtedness until May, 1904, when a mortgage of $650,000 was given to secure a bond issue in like amount. The entire proceeds from the sale of bonds, with an additional $100,000 advanced by the stockholders on the company's note, was put into the reconstruction of the property. The physical condition of the plant previous to the reconstruction was exceedingly bad, and the entire income was required for repairs and operation, leaving no surplus for dividends or other purposes.

"Under Article XIII of the general trust deed the following provision is made for a sinking fund:

"'A sinking fund shall be created and maintained during the uncancelled existence of this mortgage for the payment in part of the principal of the bonds hereby secured, and shall consist of the payment in the sum of $15,000 on the 30th day of April in each year on and after April 30, 1908, by the company to the trustees, which annual payment company agrees to make to the trustees.'

"'It is further provided that the trustees shall hold the annual payments until the disbursement thereof, allowing the company interest thereon; this interest to be added to the sinking fund annually. The money so accumulating shall be used from time to time for the purchase by the trustees of the bonds as a price not to exceed 5 per cent par; the bonds so purchased shall be cancelled and delivered to the company.'

"You will note that the annual payment of the $15,000 is not effective until 1908. We are with the commencement of the year, however, charging off 20 per cent of the gross receipts each month to depreciation and maintenance. From this amount we subtract the actual maintenance cost for the month, the balance being charged to depreciation.

"In my opinion there are few companies in the State which have a broad provision for depreciation and sinking fund. This provision should undoubtedly be made, otherwise at the expiration of the life of the bond issue, the property will be sadly depreciated in value and no funds in hand to put the same in the physical condition which attained at the issuance of the bonds.

"Capital is becoming more insistent that sinking fund provisions be made, although the majority of bond issues now in effect carry no such provision."

The above quotations and other information contained in the letters of the members who believe in and practice the recognition of depreciation as a factor in central station finance are from cities of from 3,000 to 50,000 population widely distributed over the State. Evidently some plant managers are thinking hard over the question.

Reference has been made to members presenting arguments against depreciation as an element of productive cost. One member writes, "In regard to depreciation, I will say that I differ from most people on this subject. We do not charge off any depreciation. When any part of our machinery gives out we repair it or replace it with new and charge it to expense. If a pole is decayed and unsafe we replace it with a new pole and charge it to expense, and so on through the entire system. In this way we pay for our depreciation as it comes. We classify our accounts to a certain extent. We have an account for meters, transformers, coal, repairs to boilers, station supplies, equipment, etc. Meter repairs are charged to expense, and new additional meters are charged up to meters. A new meter to replace an old one is charged to expense. Same with trans-

formers, etc. Annually, or as often as desired, we can balance up our accounts and see how we stand."

But he concludes with this statement, "If a plant is making more than a fair dividend I would set aside some of it for a surplus and put it in a good bank at interest. Then in case of a breakdown or extension of plant there would be some ready money."

It would seem as though the last statement qualifies materially the non-belief in depreciation accounts and that the writer really would charge off depreciation if his business would pay him well enough to enable him to do so.

Another member writes, "If a plant is earning sufficient money to take care of the maintenance which must include all replacements and renewals, and interest on the investment, and has anything left it would seem better to pay it to the stockholders in extra dividends than to run the risk of holding it in a sinking fund. Keeping the fund safely would be a problem. Keeping it profitably invested, still more of one; but when it is paid to the stockholders as it accumulates all this is avoided."

To this view of the case there might be presented the question, How will these same stockholders feel if extraordinary expense, such as replacing obsolete equipment, necessitate an assessment? and how much worse will their heirs or assigns feel who have not directly received the previous large dividends? Is it not better to anticipate such a contingency by having a fund to meet it?

The author then takes up the theory of depreciation calculations as laid down by Matheson in his book on "Depreciation of Factories," and figures on a concrete example of factory depreciation. He also quotes percentages of depreciation from Dawson's "Engineering and Electric Traction Pocket Book."

As to the method of investment of the depreciation sinking fund, there are several avenues for ready money. Improvements in the plant or extensions are legitimate if they will pay the interest on which the annuity is based. Otherwise not. A line 10 blocks long to supply light to one or two houses at the end would not be remunerative enough for this purpose. It should be constantly borne in mind that the depreciation allowances are each specific and their use for other purposes should not be tolerated.

Repairs and maintenance must be regarded as distinct from depreciation sinking fund, and it is necessary that they be otherwise provided for.

Test of a Curtis Turbine at Waterloo, Iowa.

At the Iowa Electrical Association convention at Des Moines, April 18, figures on the official test of a 500-kw Curtis steam turbo-alternator at Waterloo, Iowa, were given by Austin Burt, superintendent, and Niels Christensen, chief engineer of the electrical department of the Citizens' Gas & Electric Company, in which company's station the turbine was installed. The tests were carried on entirely by the operating company. The steam consumption was determined by weighing the condensed water. The report is as follows:

The turbine is of the latest four-stage type and was placed in service February 9, 1906.

Steam is supplied at 150 lb. pressure without superheat, and efficient means is employed for removing moisture. The step-bearing is furnished with water under 300 lb. pressure by a pair of duplex pumps, one being held in reserve. No accumulator is used. Oil for the middle and the top bearings is supplied by small duplex pumps. The condensing apparatus is of the surface type, and the air pump is of the Edwards type, and is driven by a 12-hp motor. A centrifugal pump driven by a 30-hp motor is employed for supplying circulating water to the tubes of the condenser.

The condensed water for measurement was discharged into a tank arranged with compartments so that the step bearing water can be taken from the first compartment and returned to it, thus eliminating entirely the correction for the step-bearing water.

Excitation current is furnished by a 25-kw horizontal Curtis turbo-exciter, the steam from which is used for heating feed water in an enclosed heater. The steam from the feed pump is also used in the same heater. By means of by-pass valves it was possible to determine the steam consumption of both of these auxiliaries. The steam used by all of the step-bearings and the oil pumps was condensed by coils immersed in cold water, and thus the amount of steam which was consumed by these pumps was ascertained.

All of the instruments and weighing scales were carefully checked and calibrated before the test and may be relied upon within one per cent.

The conditions of the test are as follows: First, one-half load; second, variable load; third, full load; fourth, 50 per cent overload. (All without auxiliaries.)

The normal load on the station varies from 300 kw to 500 kw, and a water rheostat was provided in order to secure sufficient load for overload test and maintain uniform operating conditions.

Following the tests on the turbine a series of three tests was made on two reciprocating engine-driven units: These units are: One 450-hp cross-compound condensing Buckeye engine, direct-connected to a 300-kw General Electric alternator. One 200-hp cross-compound condensing Buckeye engine direct-connected to a 133-kw General Electric alternating-current generator.

The condenser for this equipment is of the Wheeler admiralty type, with water, steam and air pistons on one rod. These units are excited by the turbine exciter. The conditions of the tests are as follows: First, 300-kw engine alone, full load; second, both engines in parallel, full load; third, both engines in parallel, variable load. In each of these tests no account was taken of the steam used by the auxiliaries.

The results of these various tests are as follows:

TABLE I.

	A Length of test, hours.	B Average load, k.w.	C Per cent of capacity.	D Steam pressure, lbs.	E Vacuum in ins.	F Total steam used, lbs.	G Steam per k.w. hour, lbs.	H Builders' guarantee, lbs. per k.w.-hour.
1. Turbine; ½ load.....	1	253	50.6	150	27.87	5,487	21.67	23.5
2. Turbine; variable load.	8	366	73.2	149	26.91	63,955	21.82	23.0
3. Turbine; full load.....	2	518	103.6	147	27.81	20,370	19.61	21.
4. Turbine; 50% overload	1	750	150.	144	28.02	14.635	19.52	21.5
5. 300-k.w. engine, full load.	1	301	100.5	147	21.70	6,432	21.34	24.15
6. 300-k.w. engine, full load and 133 k.w. engine in parallel.....	1	432	100.0	141	20.42	10,084	23.34	24.82
7. 300-k.w. engine and 135 k.w. engine in parallel on variable load....	2	292	67.4	129	22.29	15,423	26.52	...

The vacuum under column E is absolute, and the steam per kw-hour under column G is connected for moisture and vacuum on the basis of 1.25 lb. for each inch of variation from 28 in. absolute.

TABLE II.

	Average, k.w.	Step and oil pumps, lbs.	Circulating and air pumps, lbs.	Exciter, lbs.	Total auxiliaries, lbs.	Generator, lbs.	Total generator and auxiliaries, lbs.	Total coal per k.w.-hour, lbs.
8. Turbine; ½ load.....	253	.47	2.86	1.61	4.94	21.67	26.61	4.09
9. Turbine; variable load	366	.31	2.01	1.05	3.37	21.82	25.19	3.87
10. Turbine; full load....	518	.24	1.28	.95	2.47	19.61	22.08	3.27
11. Turbine; 50% overload	750	.18	.88	.65	1.71	19.52	21.23	3.34
12. 300-k.w. engine; full load.....	301	..	1.46	3.32	4.78	21.34	26.12	4.03
13. 300-k.w. engine and 133-k.w. engine at full load and in parallel....	432	..	1.28	2.36	3.64	23.34	26.95	4.24
14. 300-k.w. engine and 133-k.w. engine on variable load in parallel....	292	..	1.89	3.25	5.14	26.52	31.68	4.88

In Table II will be found the combined results of the generator and auxiliaries together with totals used per kw-hour. The results are all referred to the kilowatt load on the generator, thus giving the relative amount of steam required to operate each auxiliary.

Ithaca Meeting of the American Electrochemical Society.

The ninth general meeting of the American Electrochemical Society was held in Ithaca, N. Y., from May 1 to 3. In our last issue mention was made of the fact that the first session was opened by a felicitous speech of the president of Cornell University, Dr. Schurmann, who pointed out the interests which Cornell University and the American Electrochemical Society have in common in applying science to the wellfare of mankind. Prof. Bancroft replied as president of the society.

In the short business meeting of the society which followed, the results of the election of officers were announced, Mr. Carl Hering having been chosen president. Some other announcements of general interest made during the following days were to the effect that the Frenzel prize for a paper on rare metals has been given to Mr. Gin, of Paris, and that the first grant of $100 out of the society's funds for special research work has been awarded to Dr. Lincoln, of the University of Illinois, for an investigation on the electrolytic corrosion of brass and special bronzes.

The mornings were devoted to the reading and discussion of papers, the afternoons to visits and excursions. On the afternoon of May 2 the chemical laboratory, the dynamo laboratory, the engineering laboratories and shops of Cornell University were visited. On May 3 excursions were made to the filtration plant of the university, to the hydraulic laboratory, the power plant in the gorge and to the works of the Ithaca Gun Company, while in the afternoon of May 4 an excursion was made to the very interesting works of the Remington Salt Company.

On the evening of May 2 a most enjoyable smoker was held in the rooms of the Town and Gown Club, while the next night a subscription dinner was served at the Ithaca Hotel, Mr. H. B. Coho distinguishing himself as toastmaster.

On the afternoon and evening of May 3 many of the Electrochemical Society party attended a lecture of Mr. E. G. Acheson on "Discovery and Invention" in the Sibley Dome, while in the evening of the same day Dr. Wiley lectured on some special points of the pure food problem.

The general feeling of good fellowship and the excellent quality of most of the papers presented rendered the Ithaca meeting one of the most successful ones in the history of the society.

In the following we give concise abstracts of all the papers presented in the afternoon:

AN INSTRUCTIVE LABORATORY EXPERIMENT IN APPLIED ELECTROCHEMISTRY.

The first paper of the session of May 2 was presented by Prof. W. H. Walker, of the Massachusetts Institute of Technology, who pointed out that one of the most important functions of a laboratory experiment in applied chemistry, as distinguished from an experiment in general or pure chemistry, is to enable the student to acquire an economic point of view. The principal requirements of experiments of this nature for laboratory work were discussed and as an example of a method meeting the chief requirements more or less perfectly was mentioned the preparation of bleaching liquor by the electrolysis of brine without a diaphragm.

The author described in detail how to arrange the experiments relating to this problem and how to plot instructive curves from the experimental results. The last of these curves gives the cost of the process and the minimum point of the curve indicates the best conditions under which the process may be carried out. Dr. Walker recommended the division of a class of students into different groups working under slightly different conditions and the final summarization of the whole work of the class in curves so as to find the best possible method of operation.

SOME PRINCIPLES OF THE RESISTOR FURNACE DESIGN.

A highly mathematical paper, making free use of calculus, was presented on this subject by Mr. C. L. Collens, Jr., whose analysis resulted in the following practical conclusions for the design of electric resistance furnaces in which the current passes through the resistor only. Increase as far as possible the ratio that the surface of productive heat diffusion bears to the surface of non-productive heat diffusion. Increase up to the economical commercial limit the rate of energy supply per unit of surface of productive heat diffusion. Avoid as far as possible in the furnace design, shapes or conditions which give lines of flow of heat which are widely diverging. Surround the productive zone of the furnace with materials which are as refractory as possible both as regards thermal conductivity and thermal capacity, and which will still withstand the conditions to which they are exposed. The application of the principles evolved in the mathematical analysis to actual design of various electric resistance furnaces formed the conclusion of the paper.

ELECTROLYTE DENSITY IN STORAGE CELLS.

A paper on this subject by Mr. Lamar Lyndon was then presented in abstract. The author stated that the ordinary formula for the reaction in the lead cell according to which two molecules of lead sulphate and two molecules of water are formed during discharge from one molecule of lead peroxide, one of lead and two of sulphuric acid. But in practice it appears that the higher the rate of discharge the less is the abstraction of sulphur and oxygen from the electrolyte between the plates and the smaller its diminution in density. This fact, however, does not contradict the above theory since the electrolyte which undergoes the chemical reaction is essentially that acid which is contained in the pores of the plates and not outside between the two plates.

The author then discussed at some length the best density in storage cells. This depends, of course, on other factors. For instance, a plate in which the active material is thin and very porous, gives the maximum amp.-hour efficiency with an electrolyte of lower density than a plate with a thick layer of active material. The proper theoretical density of the electrolyte for any cell is that which will most nearly average 1.224 specific gravity (maximum of conductivity) throughout the range of operation. The author further gave a formula for computing the quantity of electrolyte required in cells. The paper was concluded by the following table giving averages of general practice in the United States concerning the electrolyte in storage cells, its initial and terminal densities and average quantities.

Kind of plates.	Character of service.	Discharge rate in hours.	Density—initial.	Density—terminal.	Lbs. electrolyte 100 amp-hours.
Pasted positive and negative.	Motor car propulsion	4	1.300	1.100	4
Planté positive pasted negative.	General use small sizes	8	1.210	1.187	22
do	General use large sizes	1 8	1.210	1.177	15
Planté positive and negative.	General use small sizes	8	1.200	1.180	25
do	General use large sizes	8	1.200	1.165	15

ELECTROLYTIC CORROSION OF STRUCTURAL STEEL.

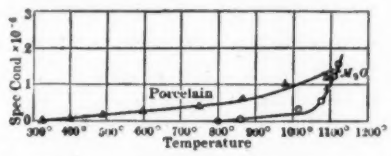
A paper by Mr. Maximilian Toch deals with the important problem of protecting the steel structures of buildings, etc., against the electrolytic effects of stray currents. While such destruction goes on, the author emphasized that it is not nearly as bad as some people think. He had made extended tests in which two pieces of steel of known high-grade quality were immersed in wet earth and a small current from an outside source sent from one plate to the other for a long period. In every case the anode plate rusts very rapidly while the cathode plate remains in good condition and free from corrosion. The first oxide which appears on the anode is the green oxide. When a third plate, not connected to the circuit, was inserted in the earth between the other two plates, it showed corrosion almost midway between that of the two others. Electrolytic rust is a totally different oxide of iron than chemical rust. Steel cannot be protected against corrosion by simply embedding it in concrete, but the proper way is to first cover it with an insulating paint and then place it in concrete. This method has already found application in the power house of the Pennsylvania Railroad in Long Island City and in other places.

In the discussion Mr. Carl Hering suggested to connect the steel structure with a large piece of zinc so as to make the steel structure naturally cathode. (The same method is already used

with boilers.) Mr. Acker spoke at some length on the destruction of gas pipes from stray currents from a railway system. In the special case referred to the remedy consisted in improving the bonds between the rails and installing special return feeders. Mr. Hering pointed out that it is not proper (as is usually done in investigating the stray currents of railways) to assume a large current with a large difference of potential since this method does not take into account at all the conductivity of the ground, which may vary immensely.

FUSED MAGNESIUM OXIDE.

A paper by H. M. Goodwin and R. D. Malley gave the results of an experimental investigation of the physical properties of fused magnesium oxide, as well as some notes on the construction of articles from this material. The specific gravity is about 3.5 to 3.6, the melting point about 1,920° C., while the specific conductivity may be seen from the adjoining diagram, which also gives a comparison between the conductivity of porcelain



COMPARATIVE CURVES OF ELECTRIC CONDUCTIVITY OF PORCELAIN AND FUSED MAGNESIA.

and magnesia at different temperatures. As Mr. Hering pointed out in the discussion, the specific conductivity is evidently given here in meter-square millimeter-reciprocal ohm units. At temperatures below 1,100° C., magnesia is a much better insulator than porcelain. There is a close agreement between the value efficiency of fused magnesia and that of platinum, and this should prove a valuable property in the construction of apparatus involving joints of the two materials. Fused magnesium oxide possesses in a remarkable degree the ability to withstand chemical action of many neutral salts at high temperatures.

In the discussion Messrs. FitzGerald and Bennie pointed out the very large effect which the addition of small impurities has on the properties of the material. Mr. Hering called attention to the fact that at 1,500° C. the resistivity of magnesia is 700,000 times as great as that of copper at ordinary temperatures, while the Nernst lamp has a resistivity 400,000 times that of copper.

CATHODE DISINTEGRATION OF CARBON—REDUCTION OF METAL SULPHIDES—A NEW SILICIDE OF MOLYBDENUM .

Three papers with the above titles were then presented together in abstract by Prof. C. F. Burgess, all three papers emanating from the University of Wisconsin. The first paper, by G. I. Kemerrer, on the cathodic disintegration of carbon in an electrolyte of fused sodium chloride, calls attention to the fact that carbon remains unattacked as anode and is rapidly consumed when used as cathode. Some experimental results were given.

The second paper, by O. W. Brown, refers to the reduction of metal sulphides to metal, when mixed with lime and carbon and heated in an electric furnace. This process is successful with zinc sulphide and with molybdenite, the reduction being complete. On the other hand, reduction and distillation of antimony from a charge of stibnite, lime and carbon is incomplete.

The third paper, by O. P. Watts, refers to a new silicide of molybdenum having the formula $MoSi_2$.

A NEW SODIUM PROCESS.

The last paper of the Tuesday session was presented by Mr. Edgar A. Ashcroft, of London, England, on his new electrolytic sodium process, which is to be worked in a plant in Norway. Its chief commercial advantage rests in the fact that the metallic sodium is here obtained from the cheap sodium chloride, while in the Castner process, now in commercial use, the more expensive sodium hydroxide is electrolyzed. The equipment consists of two cells: in the first fused sodium chloride is electrolyzed with a fused lead cathode (just as in the Acker process); the molten lead-sodium alloy is passed over into the second cell, where it forms the anode, fused sodium hydroxide being the electrolyte and metallic sodium being set free at the cathode as in the Castner cell. The sodium hydroxide in the second cell is not consumed. The author described a device for stirring the solution by an electromagnetic device. In the discussion which followed, several speakers questioned the efficiency of this electromagnetic stirring method, but Mr. Ashcroft pointed out that this requires so little power that the efficiency has comparatively no effect.

PRESIDENTIAL ADDRESS.

At the last convention Prof. Wilder D. Bancroft had presented an experimental lecture on the chemistry of electrochemistry in which he emphasized that in many cases it is useful to consider electrochemical reactions (especially secondary reactions) from a purely chemical point of view. His address as retiring president, which was presented on the evening of Tuesday, dealt with the electrochemistry of chemistry and showed how electrochemical methods may be made use of for studying problems which are apparently strictly chemical. This point of view was illustrated by many examples relating to chemical and electrolytic corrosion. It is a general rule that if a metal becomes passive as anode in a solution it cannot chemically rust in such a solution. To study the chemical corrosion of iron, steel and other alloys would require a very long time during which it would be most difficult to keep the conditions constant, while the parallel case of electrolytic corrosion can be easily and exactly investigated.

LABORATORY RESISTANCE FURNACE.

The first paper of the Wednesday session, by Mr. G. R. White, described laboratory furnaces for the production of calcium carbide and carborundum. Two types of resistor were used, one a carbon rod and the other a core of crushed pressed carbon. The furnaces are cheap and instructive and may be used to advantage where not too much power is available in a laboratory.

ELECTROCHEMICAL PROCESSES AS STATION LOAD EQUALIZER.

Mr. E. A. Sperry pointed out the possibilities of central stations giving off electric energy at times of low load to electrochemical industries for cheap rates. He divided the central stations into three classes, according to the length of time during which they can guarantee to deliver energy to the electrochemical plant. In the first class energy for 98 per cent of the whole hours in the year can be guaranteed; in the second class 96.5 per cent and in the third class 92.6 per cent. To avoid transmission cost, it would be useful to erect an electrochemical plant which intends to take energy from the central station near the same. Mr. Sperry had inquired concerning the price at which central stations would be willing to supply energy at times of low load; this price varies between 0.28 cent and 0.41 cent per kw-hour. In the discussion Dr. J. W. Richards emphasized that almost all electrolytic processes are continuous, but that some electrothermic processes are intermittent, and these latter ones could be utilized in this connection. Mr. Howard called attention to the availability of exhaust steam which could be sold from large power stations to chemical industries for evaporating purposes. Dr. Bancroft remarked that at the Remington salt plant (which was visited) electricity is generated for light and traction purposes, while the exhaust steam mixed with some live steam is used for evaporation.

VACUUM FURNACE.

A very interesting paper on an electric vacuum furnace was presented by Mr. W. C. Arsen. The furnace is of the resistance type and is very well worked out in detail, the resistor being a helix of graphite inside of which a crucible containing the articles to be heated is placed. The estimation of the temperature in the furnace is easy since temperature and current have a fixed relation to each other. It is possible to reach 3,100° with the furnace, but the life of the resistor is short in this case; 2,700° C. seems to be the evaporizing point of carbon in a vacuum.

ELECTROLYTIC CORROSION AND ELECTRODEPOSITION OF BRONZE.

Two papers by Mr. B. C. Curry gave very interesting applications of the general principle of chemical and electrochemical corrosion, explained the night before by Dr. Bancroft. Mr.

Curry's experiments related to the special case of copper-tin alloys. The author experimented with sodium nitrate, sulphate, acetate, chloride and other solutions. The results confirm the parallelism between lack of chemical corrosion and anodic passivity. In the case of bronze the passivity is due to a film which was found to consist practically of tin oxide. All the bronzes dissolve in the chlorides. The results were checked by parallel tests with chemical corrosion. The second paper presented by Mr. Curry somewhat later during the same session referred to the reverse problem, namely the electrodeposition of bronze. In this case it is impossible to get good deposits from the chlorides; the best results were obtained with ammonium oxalate, made slightly acid with oxalic acid.

CORROSION OF IRON.

A paper by Prof. C. F. Burgess and Mr. S. G. Engle gave the results of a study of the corrosion of iron by acids. Of course the rate of solution depends largely upon the elements with which the iron is associated. But the percentage of purity is not the controlling factor, as is shown by the observations of the authors that the heated and unheated specimens of electrolytic iron, essentially the same as far as chemical composition is concerned, exhibited the widest possible variations in rate of solution. The crystalline or granular structure of iron seems to influence rates of corrosion in a marked degree.

The rapidity with which unheated electrolytic iron liberates hydrogen in a dilute acid solution suggests a useful application of this material in the production of pure hydrogen by replacing zinc which is now commonly used. Electrolytic iron liberates hydrogen about four times as rapidly as does pure zinc and twice as rapidly as the commercial grade. Another advantage in the use of electrolytic iron for hydrogen generation lies in the greater purity of the resulting gas as compared with that obtained from zinc.

Traces of arsenic exert such a marked influence in protecting iron from the corroding action of acids that the employment of this element for protection against ordinary corrosion appears worthy of further investigation.

NICKEL PLATING.

A brief paper by Mr. Isaac Adams gave a sketch of the development of the nickel plating industry in the sixties. His remark that the art is to-day carried on substantially as it was in 1869 and 1870 with the same solutions, the same anodes, and the same details of shop manipulation, was resented in the discussion. Prof. Bancroft suggested to add a slight percentage of nickel chloride to the usual electrolyte and use rolled copper anodes.

LEAD FROM ACETATE SOLUTIONS.

In a brief paper on this subject R. C. Snowdon showed that it is quite possible to get a good plating deposit of lead even from an acid solution (by using a revolving cathode and a slight addition of gelatine to the solution and proper conditions of current density and temperature). The favorable conditions are the same for lead as for the other metals, but the method is not intended to be commercial.

STRUCTURE OF ELECTRODEPOSITS.

A paper by Prof. C. F. Burgess and Mr. O. P. Watts was essentially an exhibition of numerous lantern slides showing the structure of electrolytic iron deposits and pointing out some analogies in the structure between electrolytic deposits and geological deposits. While the photographs were extremely interesting, it is of course impossible to abstract the paper without the illustrations.

CADMIUM STANDARD CELL.

The next paper, by Dr. G. A. Hulett, on the Weston standard cadmium cell, brought an almost sensational announcement with respect to the important question of the Weston cell as a primary standard. Dr. Hulett was formerly Prof. Carhart's co-worker on the cadmium cell and has more recently continued this research at Princeton. He produced in his paper a great amount of evidence showing a drifting of the cadmium cell's e.m.f. in the course of time. It is slight, but it is there, and the trouble is not due to the mercurous sulphate. It appears that the cathode leg, as at present constructed, is not a system in equilibrium. While the cadmium cell is an ideal secondary standard, the above observations would seem to eliminate it as a primary standard. The paper was discussed by Messrs. Patten, Miller and Bancroft.

FERRO-MANGANESE ANODES.

The last paper of the Wednesday session, by G. R. White, referred to ferro-manganese anodes in caustic potash and especially to the secondary reduction of the permanganate to the green manganate under certain conditions.

COLLOIDS.

The first paper of the Thursday session was on colloids, Dr. H. E. Patten, of the Bureau of Soils of Washington being the author. The paper was not experimental, but philosophical, and discussed the migration of colloids as an adsorptive phenomenon with as few hypotheses as possible.

REGENERATION OF AIR BY OXONE.

A paper by Dr. R. von Foregger and Mr. G. F. Brindley gave reports of experiments with fused sodium peroxide ("oxone") for the regeneration of air in submarines. Oxone when acting with water forms sodium hydroxide and oxygen, which is given off as gas. If there is carbon dioxide in the air it is absorbed by the sodium hydroxide in solution, forming sodium carbonate. The experiments of the authors show that it is decidedly practical to use oxone for the regeneration of air in enclosed spaces, which are to support animal and human life. The process is, therefore, specially applicable for submarine boats, but was also recently advocated by Dr. von Foregger for the purification of air in the New York Subway.

SWITCHBOARD.

A brief paper by Prof. W. D. Bancroft gave a description of the very convenient lecture room switchboard used by him for his electrochemical lectures.

ALTERNATING-CURRENT ELECTROLYSIS.

A paper by G. R. White discussed alternating-current electrolysis of a solution of sodium hyposulphite with cadmium electrodes yielding cadmium sulphide. The efficiency is, however, too low for a commercial process. The author found that the efficiency depends almost entirely on the electrode surface exposed and is practically independent of current strength, of temperature and of stirring.

ELECTROLYTIC CHROMIUM.

A paper by Prof. Max Le Blanc, of Karlsruhe, Germany, was essentially a reply to some criticisms in a former paper by Carveth, and also gave the results of an experimental investigation made in the author's laboratory. He concluded that thin deposits of chromium of finest quality can be applied on brass, carbon and copper from a chromium alum solution, but he did not succeed in getting a thicker deposit than 0.13 mm. In the discussion it was stated by Dr. Carveth and Prof. Bancroft that it is quite possible to get thicker deposits, and it was suggested to use chromium acid as electrolyte.

FREE ENERGY.

A highly theoretical paper by Dr. M. deK. Thompson, Jr., gave a summary of calculations of the free energy of some halogen and oxygen compounds computed from the results of potential measurements. The paper was read in abstract by Prof. Miller.

ELECTROLYSIS OF CAUSTIC SODA.

A paper by Prof. J. W. Richards on this subject gave a historical review of the various processes for electrolyzing caustic soda for the production of sodium, which have been either proposed or introduced into practice. The full paper when printed will be useful for reference.

POTENTIAL DIFFERENCES.

A paper by Prof. L. Kahlenberg and Mr. A. S. McDaniel gave the results of an experimental determination of the potential

difference between manganese and lead peroxides and various aqueous and non-aqueous solutions. The general conclusion of the authors is that the difference of potential between the peroxide electrode and the solution into which it dips is to be ascribed to the chemical affinity; that is, chemical strain or potential between electrode and liquid.

SILVER COULOMETER.

A paper by Prof. H. S. Carhart and Mr. F. S. Willard recommends the use of silver perchlorate as electrolyte in the silver coulometer (or voltameter) and it is stated that this electrolyte eliminates all the disadvantages of the nitrate solution.

ERRORS IN PYROMETRY.

The last paper of the convention, which was by E. S. Shepherd, related to errors in pyrometry. With the thermo-electric pyrometer it is necessary to avoid the contamination of the element, to take care that the galvanometer needle does not stick and to make sure that the cold junction is kept at constant temperature. The thermo-electric element and the material to be investigated must be in very intimate contact. The author emphasized the importance of the time factor in such measurements. In the radiation pyrometer errors are sometimes due to the body not behaving strictly as a black body, while in certain cases dense vapors are given off which prevent exact measurements. In the discussion Mr. F. F. Schuetz pointed out that the new thermoelectric pyrometer of Prof. Bristol avoids many of the disadvantages mentioned by the author, especially by the automatic compensation for the error due to changes of temperature of the cold junction.

On a motion of Prof. Richards resolutions were passed expressing the thanks of the society to the authorities of Cornell University and to all those who had made the meeting such a pleasant and full success.

Accuracy in Wiring Calculations.

Mr. Albert Scheible read a paper before the electrical section of the Western Society of Engineers of Chicago, April 20, on the subject, "What Degree of Accuracy Is Feasible and Necessary in Wiring Calculations?" Mr. Scheible showed that many of the common refinements in wiring calculations were entirely unnecessary in practical work because of the inherent inaccuracy of many of the factors in any ordinary wiring problem. Hs suggested that for rough work wiring tables could be used in which the figures were not carried out as many decimal points as is usual. An interesting discussion followed the reading of the paper. Chairman Junkersfeld said that the difference in heat radiation from conductors in different locations will make enough difference in results to upset many fine calculations. Mr. George A. Damon brought out the many variable factors entering into the calculation of feeders, especially feeders for railway work. The permissible drop may vary so greatly, according to the ideas of the builders and the condition of the company's treasury that an intelligent guess is often better than fine calculations. He thought, however, that the young engineer should guess with considerable caution, especially at first, and that only after having done some careful calculation in advance. His company had probably been responsible for the installation of several million pounds of feeder copper in the last few years and yet out of all that only one test had been made for conductivity. Perhaps greater attention should have been given to this matter, but there were other factors which would throw calculations off even more than a slight difference in conductivity, especially in railway work.

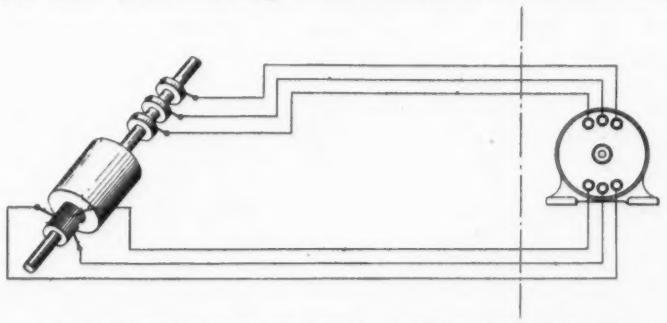
Mr. Junkersfeld, in speaking of the conductivity tests, said that his company—the Chicago Edison—had been averaging an installation of approximately one million pounds of copper per year for several years, in which time only two tests of conductivity had been made. This he believed due, however, not so much to indifference to this matter as to the fact that commercial copper of such purity is now turned out that the conductivity is in any event so high that it is not necessary to subject the material to test.

Prof. Morgan Brooks, of Urbana, Ill., who at one time had charge of the wire testing for the Bell telephone interests of the country, gave a long list of possible errors in the appraisement of conductivity of copper wire and in the calculation of wiring. The determination of copper wire conductivity is extremely difficult because of the trouble in measuring the diameter of the wire. Wire is usually not round after it has been wound into coils. He had sometimes found wire which, according to all tests, he could make, had over 100 per cent conductivity. Being fearful of losing his job, however, he was careful never to make such a report, but to simply say the wire was up to specifications.

Prof. P. B. Woodworth told of a similar experience in finding a wire of 101 per cent conductivity. He had not been so diplomatic as Prof. Brooks, however, and had made an exact report, with the result that he got no more tests to make for that customer. He did not altogether agree that all commercial copper wire is good enough so that it does not need testing. He had tested some which looked as good as any but which had only 70 per cent conductivity. Some of the brasses used in lugs and switch terminals are most deceiving, having frequently such low conductivity that they cause overheating and melting of switchboard fuses. He always urged upon his students not to let their mathematics run away with their common sense in making calculations and cited some amusing examples where calculations were carried out a number of decimal points, while the accuracy of measurement could not be even within one decimal point. The ethics of the wiring table are bad because a table purports to give exact figures on matters which are necessarily approximations. It would be better if a table should give the upper and lower limits within which variation might reasonably be expected or within which authorities differ, and then a student would know within what limits of error he was working.

A Variable-Speed Power Transmission System Using Induction Motors.

The accompanying diagram illustrates a method of operating an induction motor at four different speeds, as disclosed in a patent issued April 24 to Mr. William Stanley. A double-frequency generator supplies 5-cycle current to the stator winding and 15-cycle current to the rotor winding of the induction motor, one or both, as may be desired. Assuming a two-pole induction motor, it will operate at 300, 600, 900, 1,200 r.p.m., according to the connections of the stator and



STANLEY VARIABLE-SPEED POWER TRANSMISSION SYSTEM.

rotor windings to the supply systems. When the stator winding receives 5-cycle current and the rotor winding is short-circuited on itself, the speed will be 300 r.p.m., less the slip. A synchronous speed of 600 r.p.m. is obtained by energizing both the rotor and the stator simultaneously, the revolving fields in the two members being arranged to travel in the same direction. When the rotor winding receives 15-cycle current and the stator winding is short-circuited on itself, the speed will be 900 r.p.m., less the slip. A synchronous speed of 1,200 r.p.m. is obtained when the revolving fields in the two members are arranged to travel in opposite directions.

The Electric Furnace in Iron and Steel Manufacture.

At the April meeting of the Faraday Society in London, several papers were presented on the use of the electric furnace in the manufacture of iron and steel. Mr. C. A. Keller describes an installation of his process by J. Holtzer & Co. at Unieux (Loire) France. This is a 1,500-hp plant, and will utilize in a single furnace the current from a 20,000-amp. Westinghouse alternator. The furnace, which rests on a steel cradle and can be tilted, weighs about 50,000 kilos; the various mechanical and electrical controls are obtained by hydraulic motors. The steel obtained from a Siemens-Martin furnace will be run into the electric furnace immediately after the oxidizing melt, and for the remaining operations of deoxidizing and refining, the current exclusively will be used. It will be possible to operate on 8,000 kilos of metal at one time, and the operation will be repeated three or four times in the twenty-four hours. The steel produced by this furnace is intended for cannons and projectiles. The author promises at a future date to furnish details of the results obtained.

Some experiments made at Livet comparing the metal obtained in a 1,000-hp Keller furnace with that obtained in the blast furnace, to show the proportions of carbon and silicon in castings produced in both ways. It appears that the Keller furnace allows of ready desulphurization and of easier variation in the proportions of the above elements than does the blast furnace; it would thus be advantageous for the production of soft castings and castings for mill work. The author has just set up at Livet a 2,000-hp furnace utilizing a current of 25,000 amperes, and capable of producing 20 tons of castings in twenty-four hours. This will be used specially for the industrial working of the process. Referred to the freezing of the metal in the central passage in the first furnace that had been erected, Mr. F. W. Harbord said the freezing trouble was probably only due to the special conditions of the first tests recorded, and in any case could be avoided by coupling two or four furnaces together. Regarding variation of silicon content, as a rule this was easily brought about by adding a little silicon pig, but it might conceivably, under special circumstances, be useful to vary it in the way described for the production of good castings. Professor A. K. Huntington described some experiments he carried out in 1881 with the Siemens electric furnace in which he was able to vary the silicon content from ¼ to 9 per cent. He had also succeeded in volatilizing copper and in making solid tungsten.

A paper contributed by Signor M. E. Stassano described a furnace being installed by the Forni Termoelettrici Stassano Company for the Italian War Office. It is of the author's well-known arc type, and absorbs 140 kilowatts yielding 2,400 kilos of steel in twenty-four hours. The currents are polyphase with 80 volts between each phase. The consumption of electrodes is under 5 kilos per ton of steel, and the cost of renewing the refractory covering of the furnace 10 francs per ton of metal made. The furnace is principally used for refining pig-iron and smelting scrap. The product ordinarily made is used for artillery projectiles. Mr. F. W. Harbord said the efficiency as stated was somewhat greater than in the other furnaces. For special castings there might be advantages in heating by radiation only. The figures given for carbon consumption were smaller than in the Keller or Héroult furnaces. He thought the radiation was the weak point in the furnace.

With regard to the general question of electric steel smelting, a maker had recently told him that he had sold 300 tons of such steel as crucible steel, and the buyers were so pleased with it that they were asking for more. That was strong evidence that good steel could be made in the electric furnace, but it was only high-priced steel that could be commercially made in England by such means.

A paper contributed by M. Gustave Gin described the author's canal-type of furnace as now installed at the Plettenberg Works, Westphalia. Unlike in the canal form originally suggested, the electrothermic heating and refining now take place separately, the latter in chambers which communicate with each other and with the leads by the canals, now used exclusively for heating. The construction of a 7,200-kw furnace, utilizing 60,000 amperes at 120 volts and designed to yield over 350 tons in the twenty-four hours, was described in detail. The author claims that the furnace combines the advantages of the Martin and Talbot furnaces, the separation of the operations making exact control of composition possible.

The author's combination furnace consists of a melting and oxidizing crucible, a deoxidizing and recarburetting compartment, and a final mixing chamber. The author made suggestions for various types of induction furnaces. The use of multiple canals is proposed, so that if steel is being produced, oxidation can be carried out in one canal and reduction in the other. In another suggested type, more intimate circulation and mixing of the product is brought about by means of lateral conduits connecting the respective ends of the open flues of which the channel crucible is made up.

A paper by Mr. H. S. Coleman dealt with "Cleaning of Work by Means of the Electric Current." The work to be cleaned (usually preparatory to electroplating) is suspended in a hot solution of equal quantities of brown Montreal potash and sodium hydrate contained in a wrought-iron tank. The work and the tank are connected to a dynamo, and the tank used as the anode for five to ten minutes, the voltage being about 2.5. The current is then reversed for a short time, until the surface of the work is clear and bright. The operation is repeated as many times as may be necessary. The process causes the grease, consisting chiefly of tallow, to become saponified and go into solution. The lighter dirt is thrown upon the surface of the bath and may be skimmed off; the remainder falls to the bottom. The author pointed out the economies effected by the process as against hand-scouring.

New Telephone Patents.

SWITCHBOARD IMPROVEMENTS.

The divided multiple switchboard developed by Kellogg for magneto working has been adapted to central energy working by H. M. Post, of Chicago. In this system the answering jacks are placed upon two switchboards, each having multiple jacks for its own portion of the lines. The signals are lamps controlled by relays responding to grounding push keys on either side of the line. The relays are so disposed that both operate and lock when a plug is inserted in a jack of any line, and they are thus made to serve the dual function of line and cut-off relay. One relay operated effects the proper line signal while both operated extinguishes all signals. The circuits are well developed. The patent has been assigned to the Kellogg Switchboard & Supply Company.

A second patent assigned to this company is one granted to J. G. Roberts, of Detroit, for a switchboard system providing automatic ringing. There is associated in each cord circuit a set of relays and a rotating cam device such that the insertion of a calling plug in a subscriber's jack performs all the functions of signaling. The scheme provides the following functions enumerated in the patent:

First, to effect the automatic switching of signaling current upon the line; second, to have this signaling current switched automatically on the called line at specified intervals of time, not continuously, and for a specified number of times; third, to provide for automatically signaling back to the calling party indicating a "don't answer"; fourth, to provide a visible signal that there was a "don't answer" or that the called party has answered and "hung up," which in either case serves as a disconnect signal under the control of the calling party; fifth, to automatically discontinue the ringing current when a call is answered, until after the plugs have been cleared of the jacks.

H. E. A. Andre has also patented a switchboard improvement, which is in the form of a secrecy device to prevent the operator listening in. In order to accomplish the desired result, each cord circuit is provided with a magnetic listening key which disconnects the operator as soon as the calling plug of any cord pair is inserted in a line jack. This provides for everything except

that case where the operator attempts to listen in with the answering plug of a second cord pair. To prevent this Mr. Andre uses the potential differences employed for a busy signal. To this end he connects normally to the tip of the answering plug a relay which in turn controls the listening relay in a manner such that the operator not only becomes cut off upon the attempt to plug a busy line with an answering plug, but she remains cut off until the plug is returned to its seat. The Western Electric Company has been assigned Mr. Andre's patent.

CENTRAL OFFICE APPLIANCES.

The patent for the ratchet wheel rotating shaft heat coil shown in so many recent protectors of F. B. Cook, of Chicago, has now appeared. It is shown in Fig. 1 in several views. It will be

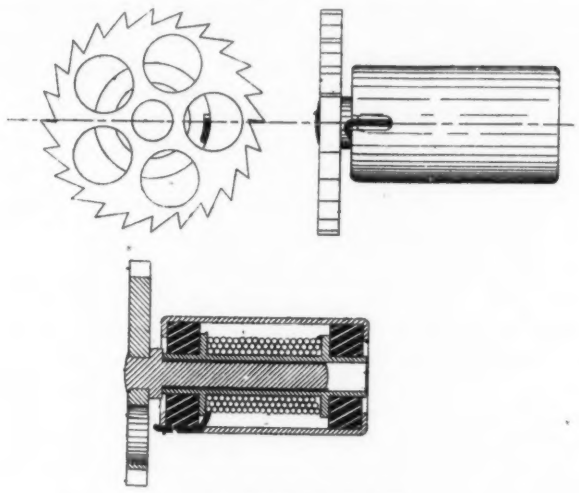


FIG. 1.—COOK HEAT COIL.

understood that at normal temperatures the shaft is locked in the coil by solder. If the coil heats, the solder softens and permits the turning of the shaft and wheel. The springs of the mounting tend to turn the shaft, and release themselves to open the circuit, by snapping off and away from the teeth if the ratchet turns under their impulse.

Another patent just granted to Mr. Cook is for his main distributing frame wherein he obtains the advantage of horizontal shelves, without introducing a horizontal terminal strip which interferes with earlier patents. The cable side terminals are short, vertical, wooden strips carrying the usual rubber strip and metal punchings. These strips are shorter than the vertical spacing between horizontal planes of the framework, and thus a long horizontal opening is left to permit the ready placing of wire upon the horizontal shelves. In order to keep the wire close to the shelves each terminal block must have a fanning ring. The combination of this, the horizontal rows of vertical terminal strip and the framework form the basis of the patent.

STATION DEVICES.

A new form of controller, or sending switch for automatic systems upon the Strowger circuits, has been invented by A. E. Stevens, of Fall River, Mass. Mr. Stevens evidently finds mistakes being made with the present type of rotary dial. He substitutes a key for depression, each key to correspond to the proper digit. He combines a cam and follower driven by the key levers, which suffices to drive the contact arm over a number of contacts corresponding with the number on the particular actuating key. He introduces refinements in the form of interlocks to prevent overlapping of successive digits.

H. Tideman, of Menominee, Mich., has been granted a patent for a desk stand of the general appearance of the present-day cylindrical upright knock-down stands. He makes his parts accessible, however, by forming the upright of two semi-cylindrical parts. One is stationary and is secured to the base and transmitter support and serves as a mounting for the switch parts. The other piece is nothing but a cover for these switch parts.

Two patents have been issued to J. Silverman, of San Francisco, for receiver supporting arms. This arm is similar to its many predecessors, but having as a special feature a cam and lever to operate the switch hook manually.

TELEPHONE INSTRUMENTS.

Fig. 2 shows what may be called an inverted solid-back transmitter, which has been patented by W. W. Dean, the patent being assigned to the Kellogg Company. The button casing, in the form of a ring of hard rubber, is secured to the diaphragm about one of the circular electrodes, which is also secured to the diaphragm. The mounting of the latter is at the diaphragm

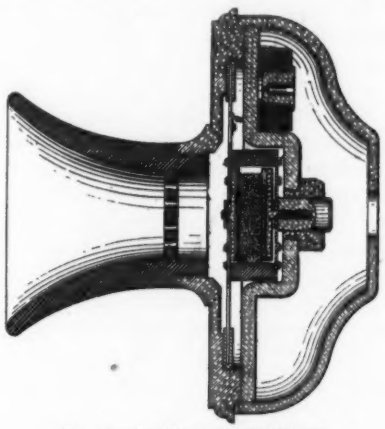


FIG. 2.—DEAN TRANSMITTER.

center, while the ring is concentric with the diaphragm and thus has little stiffening effect upon it. An auxiliary mica diaphragm serves to mount the rear electrode and close the chamber. It is claimed that by this arrangement of parts any tendency to packing is reduced by the extra agitation of the carbon granules.

K. M. Turner, of New York City, has patented a folding head receiver for the use of those requiring telephonic devices to aid the hearing. Both the head band and the attaching clamp fold so that the band may be readily placed in the pocket when not in use.

PARTY LINE SYSTEMS.

Mr. E. A. Reynolds, of New York, has patented and assigned to the Iron Telephone Company a lock-out system for party lines. The grounded side of a central energy line is connected through controlling magnets at each station to earth. If the line is carrying a current, i. e., is busy, then the grounded side will be at a potential different from that of the earth, provided, of course, the battery is grounded and there be resistance at the exchange between the ground and the grounded line limb. The circuit of the magnet is carried through the switch hook contacts so that as the hook rises the magnet circuit is momentarily closed. If the line is not busy no current will flow to earth and the circuits will all be normal. If, however, the line is busy the magnet becoming energized and thrusts its armature in the path of the hook switch, thereby displaying a busy signal and opening the local telephone circuit.

Another lock-out system has been patented, this the work of C. B. Smith, of New York. This system requires three wires throughout and thus does not seem to be on a competing basis with other systems.

LETTERS TO THE EDITORS.

Liquid Barretter Litigation.

To the Editors of Electrical World:

SIRS:—As the present status of the litigation on the liquid barretter patent has been greatly misrepresented, we would be greatly obliged if you would kindly give publicity to the following statement of the facts in the case:

The following decisions have been rendered:

1. *October* 16, 1905.—National Electric Signaling Company vs.

De Forest Wireless Telegraph Company, A. White, Le De Forest, et al. Decision in favor of the National Electric Signaling Company holding that De Forest Company infringes patent and ordering an accounting for damages.

2. *November* 8, 1905.—National Electric Signaling Company vs. De Forest Wireless Telegraph Company, A. White, L. De Forest, et al. A decree of injunction against De Forest Company, A. White, L. De Forest and the officials of the De Forest Company restraining them from using, manufacturing or selling the liquid barretter.

3. *January* 27, 1905.—National Electric Signaling Company vs. Gesellschaft für Drahtlose Telegraphie, m. b. H., et al. Decree of injunction against Slaby-Arco or Telefunken Company restraining them from the use of the liquid barretter in any of its forms.

4. De Forest Wireless Telegraph Company vs. National Electric Signaling Company. Charging the National Electric Signaling Company with infringement of the Neugschwender-Schaefer-De Forest "Goo" receiver. Suit dismissed.

5. *April* 7, 1906.—National Electric Signaling Company vs. De Forest Wireless Telegraph Company, A. White, L. De Forest, et al. Decision in favor of the National Electric Signaling Company to the effect that the "Spade" electrode used by the De Forest Company infringed the National Electric Signaling Company's liquid barretter patent, enjoining the De Forest Company against further use of this type of receiver and ordering an accounting for damages.

6. *May* 1, 1906.—National Electric Signaling Company vs. De Forest Wireless Telegraph Company, A. White, L. De Forest et al. Motion brought for contempt of court. White, De Forest and De Forest Company adjudged guilty of contempt of court and arrest ordered and bail fixed at $10,000.

Washington, D. C. Reginald A. Fessenden.

Temperature Effects in Spans.

To the Editors of Electrical World:

Sirs:—My attention has just been called to a slight error in my article on "Temperature Effects in Spans" which appeared in your issue for December 9, 1905. The right-hand member of equation 12 on page 988 should contain y cubed instead of y squared; also the corresponding numerical equation in the middle of the left-hand column, page 989, should read 300 cubed instead of 300 squared. The calculation has actually been made with 300 cubed, so that the result is correct as it stands.

Philadelphia, Pa. C. P. Nachod.

Efficiency of Lighting Balancers.

To the Editors of Electrical World:

Sirs:—Referring to Mr. Budd Frankenfield's interesting article on "Regulation and Compounding of Lighting Balancers" in your issue of December 23, to my letter of January 13 on the above subject and to Mr. Frankenfield's reply in the issue of February 3, I note that this subject has been opened again by Mr. B. F. Jakobsen in the issue of March 24. Mr. Jakobsen has brought up a point of some interest, but considerably removed from the question at issue. When a customer purchases any piece of electrical apparatus the question of conveying energy to or from it is generally settled by other conditions, and is frequently the determining factor in its purchase.

In my letter of January 13 I dealt entirely with the efficiency of the balancer set, and the losses in the wiring should, in my opinion, be more satisfactorily considered as a separate problem, since such combined results are apt to lead to some confusion or misunderstanding between the manufacturer and customer.

The writer is of the opinion that a typographical error appears in Mr. Jakobsen's formula, for throughout he appears to consider transmission efficiency of a direct-current line as the ratio.

$$\frac{\textit{Watts input} - \textit{Volts lost}}{\textit{Watts input}}.$$

If, however, we insert the missing current symbol the second equation becomes as follows:

$$\eta_B = \frac{I_n \times V - I^2 n\,(R + R_n)}{I_n \times V} = 1 - \frac{I_n R}{V} - \frac{I_n R_n}{V}$$

$$= 1 - \%\text{ volts lost in } R - \%\text{ volts lost in } R_n$$

Mr. Jakobsen's over-all efficiency is, therefore, simply the efficiency of the balancer set including the copper losses in the line.

Now, in the practical testing of a balancer set thick heavy cables are used, and the voltmeters connected directly to the brushes. The losses in R and R_n may, therefore, safely be neglected, in which case the value of the last "bracket" in the final equation is unity and the equation becomes exactly that given in my letter. I am, therefore, still of opinion that the statements contained in my letter of January 13 are substantially correct, and such apparently is the view courteously taken by Mr. Frankenfield in his letter of February 3.

Schenectady, N. Y. C. T. Wilkinson.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Reactance Voltage.—Hobart.—A description of a very simple method of estimating the reactance voltage of a direct-current dynamo, when, as is usual, the machine has only one turn per segment. In such a case one merely requires to count the number of poles and the number of segments and to know the gross

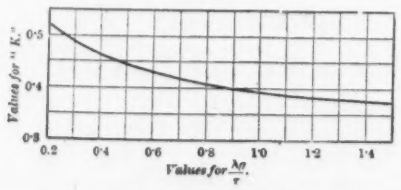


FIG. 1.—CURVE OF REACTANCE VOLTAGE.

core length, the revolutions per minute, and the rated kilowatts and voltage. The curve in Fig. 1 gives values for K for varying ratios of λg to τ, where λg = gross core length in centimeters, τ = polar pitch at air-gap in centimeters. (If D = air-gap diameter and P= number of poles, then $\tau = \left.\frac{\pi D}{P}\right)$. Having obtained K, the reactance, r, per pole in ohms may, for machines with one turn per segment and multiple-circuit single windings, be obtained from the following formula: $r = K \times \lambda g \times R \times F \times 10^{-8}$, in which R = speed of armature in revolutions per minute and F = total number of face conductors on armature. When the dynamo is loaded with a current of 1 amp., then the reactance voltage is equal to $I r \div P$. When, as will generally be the case, it is not worth while bothering about greater exactness, there may be substtiuted for K the mean value of 0.4, and the formula for the reactance per pole will then read: $r = 0.4 \times \lambda g \times R \times F \times 10^{-8}$. Several numerical examples are given and it is pointed out that this method of calculating the reactance voltage brings out clearly the influence of the three main components, namely, first, the gross length of the armature core; second, R, the speed of the armature in revolutions per minute, and third, F, the total number of phase conductors.—Lond. *Elec.*, April 20.

Periodic Variations in the Magnetic Field of a Generator.—WORRALL AND WALL.—A paper read before the Manchester Section of the British Inst. Elec. Eng. on the results of an investigation into the periodic variations in the magnetic field of a three-phase generator by means of an oscillograph. The periodic variations were observed by means of the e.m.f's induced in search coils attached to the pole pieces and to the armature, and the periodic variations in the e.m.f. induced were recorded by one pair of strips of a Duddell high-frequency double oscillograph and revolving-film camera.—Lond. *Elec.*, April 13.

Unipolar Single-Phase Machines.—A fully-illustrated reprint of a British patent specification for unipolar single-phase motors and generators of the British Thomson-Houston Company.—Lond. *Elec.*, April 20.

Single-Phase Induction Motor.—BETHENOD.—A mathematical article on an exact diagram for the single-phase induction motor. The author shows that an exact theory of this motor may be based geometrically on a circular diagram analogous to that for polyphase motors, the ohmic resistance of the rotor, however, playing a more complex part. On the basis of this diagram it would perhaps be interesting to establish a method of testing which would be more exact than that now in actual use.—*L'Eclairage Elec.*, January 27 and April 14.

Rewinding Electrical Machinery.—MEADE.—An article, illustrated by diagrams, on the windings and insulation of direct-current machinery.—*Power*, May.

Power.

French Power Transmission.—BOURGNIGNON.—A fully-illustrated description of the electric transmission system by which power generated from the Sioule Falls is transmitted over a distance of about 30 km. to Clermont-Ferrand. The power house is designed for six 1,200-hp generating sets, one of which will be for reserve. Three sets and two exciters have been actually installed. Double Francis turbines with horizontal axles drive three-phase alternators delivering a current of 460 amp. at 1,000 volts. Two sets of bus-bars are arranged in order to keep the current for power purposes separate from that for lighting. The installation is made by the Westinghouse Company, and Wurtz lightning arresters are used on the line, the transmission voltage being 22,000. At the sub-station in Clermont there are two groups of three transformers of 375 kw. The e.m.f. at the distributing network is 3,000 volts.—*La Revue Elec.*, April 15.

French Hydro-Electric Plant.—SOLIER.—An illustrated description of the Var hydro-electric plant in the southeast of France. Water power is available to the extent of about 2,500 hp. There are three 600-kw generating sets, each consisting of a double Francis 900-hp, 600-kw turbine with a horizontal axle, driving directly a three-phase alternator, which generates 11,000 volts with a frequency of 25 periods per second. Three transmission lines start from the plant. The installation was made by the French Thomson-Houston Company.—*L'Eclairage Elec.*, April 14.

Coal Testing.—HOLLIDAY.—A paper read before the Dublin Section of the British Inst. Elec. Eng. describing methods and apparatus used for coal testing. The author recommends to insert the following clause in any specification. "The coal shall be delivered in a reasonably dry state, free from stones, dirt and fine slack, and shall contain on delivery —— per cent of large, which shall be that retained on a metal screen of —— meshes to the linear foot, and shall develop when tested in a ——— calorimeter not less than —— thermal units per pound of the dry coal, and shall leave not more than —— per cent of incombustible matter when completely burned in a muffle furnace.—Lond. *Elec.*, April 13.

Electricity in Mines.—LABROUSTE.—A discussion, with the aid of diagrams, of different systems of electric winding at mines, with a discussion of their advantages.—*La Revue Elec.*, February 28, March 30, April 15.

Turbine.—LOEWY.—A mathematical article giving characteristic constants of various water turbines for the sake of their classification, together with detailed information on the Francis turbine.—*Elek. u. Masch.*, April 15.

Traction.

Single-Phase Traction.—SPRAGUE, MCCLELLAN, DEMURALT.—Three contributions to the discussion of single-phase traction. Sprague, in a letter, criticises sharply the performance of the New Haven single-phase locomotive. His criticisms are directed principally toward the performance of the locomotive at slow speeds and yard work, in which he believes it will show low efficiency and abnormal heating. He also calls attention to the great weight in proportion to the capacity of the locomotive, when compared with the direct-current New York Central machine. The criticisms of McClellan and DeMuralt are in form of discussions of the recent paper of Lamme and are abstracted in an editorial. McClellan's notes relate to the entire subject under consideration, and he is in favor of single-phase traction. He pleads for a high distributing voltage and against the third rail. He refers to the desirability of operating motors in parallel to keep the load on the motors balanced. DeMuralt advocates polyphase traction. The polyphase locomotive has a constant speed characteristic which may ultimately prove valuable when fully utilized. The series motor in its output characteristics resembles the steam locomotive. He refers to the effect of difference in diameter of drivers upon the loading of the motors. "As DeMuralt explains, the difference in loading from this cause can be corrected, while a 6 per cent or 7 per cent variation would also be likely to play the mischief even with continuous-current motors." In the matter of weights the polyphase motor has the advantage, so far as experience now goes. He thinks a single-phase locomotive will be very likely to get into trouble in starting on grades from the burning out of the short-circuited coil in spite of the high-resistance leads. All of the writers agree in advocating a higher working potential.—*St. R'y Jour.*, April 28.

Recording Meter for Tramways.—DE KERMOND.—An illustrated description of a recording meter for tramways which shows the time during which a car uses current. Since the total length of time of a trip is known, the ratio of the time during which current is used to the total time can be found, and from this the ability of the motorman may be estimated. (The good results obtained with this kind of meter in the Frankfurt system were recently noticed in the Digest.) The meter consists essentially of a clockwork which is stopped and started by means of an electromagnet actuated by the current supplied to the car.—*L'Electricien*, April 21.

Installations, Systems and Appliances.

Conditions for the Connection of Motors to Lighting Networks.—SCHUELER.—A discussion of the conditions under which different central stations in Germany permit motors to be connected to a lighting network. The author thinks regulations of this kind should fix nothing but the maximum permissible starting current and the minimum permissible power factor. Differences in the regulations of various stations are very troublesome. For instance, for a 5-hp induction motor three different stations require a power factor of 0.8, 0.85 and 0.89, respectively. The motor manufacturer is thereby forced to build the standard 5-hp type with such a weak field and such a narrow air-gap as to get a power factor of 0.89 or to design a special type. In view of the advisability to get uniform regulations, committees of the Association of German Electrical Engineers and of the Association of Electricity Works have prepared a set of regulations which is published in the same issue. The starting current of direct-current motors is fixed as follows:

Capacity of motors.		Watts per hp.
0.5 to 1 hp		3500
1 to 2 hp	For small starting current.	1500
2 to 15 hp		1250
Above 15 hp		1000
1 to 15 hp	For large starting current.	2500
Above 15 hp		2200

"The torque which can be obtained with the small starting current is, as a rule, the normal torque for motors of 1 to 15 hp, and three-fourths the normal torque for motors of more than 15 hp. The torque obtainable with the large starting current is, as a rule, twice the normal torque." The starting current of polyphase motors is fixed as follows:

Capacity of motors.		Volt-ampere per hp.
0.5 to 1 hp		3500
1 to 1.5 hp		3000
1.5 to 2 hp		2500
2 to 5 hp	For small starting current.	1600
5 to 15 hp		1400
Above 15 hp		1000
2 to 5 hp	For large starting current.	3200
5 to 15 hp		2900
Above 15 hp		2500

The starting current of single-phase induction motors is fixed as follows:

Capacity of motors.		Volt-amperes per hp.
0.5 to 1 hp		3500
1 to 1.5 hp		3250
1.5 to 2 hp		3000
2 to 5 hp	For small starting current.	2000
5 to 15 hp		1500
Above 15 hp		1250
2 to 5 hp	For large starting current.	3500
5 to 15 hp		3000
Above 15 hp		2500

In this case the torque obtainable with the small starting current is, as a rule, one-fourth the normal torque for ordinary induction motors and equal to the normal torque for commutator motors. The torque obtainable with the large starting current is, as a rule, two-thirds the normal torque for ordinary induction motors and twice the normal torque for commutator motors. The minimum power factor is fixed as follows for polyphase motors of different ratings:

Up to.....	0.5	1	1.5	5	10	15	20	Above 20 hp.
Power factor..	0.60	0.65	0.70	0.75	0.77	0.80	0.82	0.85

The minimum power factor for single-phase motors is fixed as follows:

Up to.....	0.5	1	1.5	5	10	15	20	Above 20 hp.
Power factor..	0.60	0.65	0.70	0.73	0.75	0.77	0.80	0.82

The committees appointed for the drafting of the regulations have approved them and the regulations are now to be submitted to the two associations.—*Elek. Zeit.*, April 12.

Small Electric Lighting Plant.—An illustrated article on installation and maintenance of the electric lighting plant of Jordan, Minn. It contains a 45-kw, three-wire engine-type generator giving direct current at 115 and 230 volts. Installation and operation costs are given in detail.—*Power*, May.

Electrophysics and Magnetism.

Conductivity of Flames for Alternating Current.—Wilson and Gold.—An account of experiments on the electric conductivity of a Bunsen flame containing various alkali salt vapors, the currents used being alternating ones with frequencies of from 70,000 to 6,000,000 per second. The conductivity was measured between two platinum electrodes immersed in the flame and the variation of the conductivity with the amount of salt present in the flame and with the nature of the salt was investigated. The results obtained enable a comparison to be made between the conductivities of the various alkali salt vapors for alternating currents and their conductivities for steady currents. It appears that the relative conductivities for rapidly alternating currents are nearly proportional to the square roots of the corresponding conductivities for steady currents. The flame is found to behave for very rapidly alternating currents more like a dielectric of high specific inductive capacity than like a conducting medium. These results confirm the view that the negative ions from all salts have the same velocity. The apparent capacity varies nearly inversely as the square root of the maximum applied potential difference. The apparent capacity is nearly independent of the number of alternations per second. The apparent capacity is nearly independent of the distance between the electrodes. The foregoing results are in agreement with the ionic theory of the conductivity of the flame for rapidly alternating currents when the velocity of the positive ions and the inertia and viscous resistance to the motion of the negative ions are neglected in comparison with the effects due to the number of ions per cubic centimeter. Not more than one molecule in 30 salt molecules is ionized at any instant in the flame, but each molecule is probably ionized and recombines several million times per second. The steady currents observed through salt vapors in flames are very far from the maximum possible currents corresponding to the number of ions produced per second.—*Phil. Mag.*, April.

Corpuscular Theory of Matter.—J. J. Thomson.—An abstract of his last lecture before the Royal Inst. on the corpuscular theory of matter. He had reached the conclusion that the number of corpuscules in an atom cannot be a very large multiple of the atomic weight. This result seemed to be contradicted by the existence in many spectra of an enormous number of lines, if each spectrum line is supposed to be due to a charged particle in orbital motion. But the author explained why the number of corpuscles in an atom cannot be calculated from the number of spectrum lines. He referred further to the remarkable discovery that if the secondary radiation emitted by elements under the influence of Röntgen rays may be measured by the ionization it produces within a millimeter of the surface of the substance, numbers are obtained that rise steadily with the atomic weight. If the ionization be plotted on an atomic weight base a curve of such definiteness is obtained as may prove useful in the future in fixing doubtful atomic weights. The application of the corpuscular theory to the explanation of the electrical conductivity of metals has shown that we must admit that a kind of corpuscular dissociation is continually taking place in a conductor, so that there are always numbers of free corpuscles ready to move under any e.m.f. applied. Further, if the free corpuscles be regarded as capable of carrying heat, then the ratio for different materials of the thermal to electrical conductivity can be calculated. It is remarkable that the calculations on this basis agree very closely with the experimental results.—Lond. *Elec.*, April 13.

Retardation of Alpha Particles in Passing Through Matter.—Rutherford.—A short communication on experiments in which he obtained photographic effects from alpha particles the velocity of which had been reduced to less than one-half the original velocity with which they were thrown off from an active wire coated with radium, C. The velocity was reduced by their passage through aluminum. The photographic effect observed was very feeble and less than 4 per cent of that found for the unscreened wire. This result suggests that the ionization produced by the alpha particle falls off rapidly when its velocity falls below a certain critical value. The ratio of the charge to the mass, however, remains the same as for the alpha particle emitted from the bare wire.—*Phil. Mag.*, April.

N-Rays.—At a recent meeting of the Société Française de Physique, Turpain described the results of a year's experiments undertaken to prove the existence or non-existence of N-rays. In those cases in which the experimenter knew whether the N-rays acted on the sulphur or not, the observed effect agreed in about 80 cases out of 100 with the expected results, but when the investigator had to rely solely on his observations, not knowing whether the N-rays were acting or not, the correct and incorrect guesses were approximately equally divided. "The obvious conclusion is that they were guesses. On the other hand, Gutton recently published some photographs showing the effect of N-rays on the sparks from a Hertzian oscillator. The N-ray remains a mystery."—Lond. *Elec.*, April 13.

Magnetization of Iron Powder.—Trenkle.—An account of an investigation in which the author studied the magnetism of powdered iron by means of a modified yoke method, which gives more complete results than that of Börnstein. He finds that with a given field the magnetization and the susceptibility of pure iron powder is always greater than that of a mixture of iron powder and some non-magnetic substance. Hence, the saturation point of pure iron powder is always higher than that of the dilute powder. The saturation value of the magnetic intensity is about one-fifth of that of solid iron. Generally speaking, therefore, the saturation value of the magnetization is the smaller the less the density of the iron. Thus cast iron, which has a smaller average density than steel or wrought iron, has a relatively small intensity of maximum magnetization. The field required for saturation is greater in the case of diluted iron powder than in the case of the pure powder, but this rule cannot be extended to solid iron. The effect of the change of density is entirely independent of the effect of a change in length, and must not be taken as amounting to the same. The relation between the changes produced by altering the various dimensions is very complicated.—Lond. *Elec.*, April 13; from *Wiedemann's Ann.*, No. 4.

Magnetic Ageing of Iron.—MAZZOTTO.—A paper on the magnetic ageing of iron and the molecular theory of magnetism. When it is important that the iron in a machine should not age during use, the author recommends to age the iron employed in advance by heating it from 15 to 20 hours to a temperature near 131° C. Cores thus treated will not age afterwards, whether they continually remain at normal temperature during use or are heated to temperatures permissible in practice.—*Phys. Zeit.*, April 15.

Electrochemistry and Batteries.

Storage Batteries.—GAHL.—An abstract of a paper presented before the Colorado Scientific Society. The main part deals with the present status of lead cell manufacture. Attention is called to a new type of negative plate recently brought on the market which permits the use of material of high expanding power, the falling off of active mass being prevented by a kind of perforated lead wrapper cast together with the grid. This plate is called box plate, and means a vast improvement over the negative plates made before, and it evidently seems to solve the problem of negative plates, for now the negative plates have a longer life than the positive plates, while formerly the life of the battery was always limited. The construction of this box plate is a result of theoretical considerations on the necessity of accelerating the diffusion of fresh acid into the plates during discharge. The author sees a bright future for alkaline cells when it will be commercially possible to use cadmium. He appears to consider a cadmium-silver alkaline cell as the most promising one for automobiles.—*Electrochem. and Met. Ind.*, May.

Electric Lead Smelting.—ASHCROFT AND BETTS.—Two long illustrated articles. In the article of Ashcroft the Swinburne-Ashcroft process is described consisting essentially in the decomposition of zinc sulphide in suspension in a fused electrolyte of mixed zinc chloride and sodium chloride, and also in the electrolysis of lead sulphide dissolved in a fused electrolyte of lead chloride. A diagram is given of the arrangement of a plant for this purpose and a modified system of magnetic rotary agitation in a fused electrolyte cell is described. The extended article of Betts first deals with the use of fused lead chloride as electrolyte and then with the production of a refined lead sulphide—practically lead matte to feed to the electrolytic lead cell in order to prevent the accumulation of impurities during operation. Extended thermochemical analyses are given with a comparison of cost with the old smelting process. In an editorial the two processes of Betts and Ashcroft, together with a process recently patented by Townsend, are discussed.—*Electrochem. and Met. Ind.*, May.

Leblanc and Electrolytic Alkali Works.—KERSHAW.—A discussion of the commercial development of the alkali industries in Europe in recent years. The author thinks that the Leblanc works will continue to produce caustic and carbonated alkali and bleaching powder, but in diminishing quantities, and the dividends earned by manufacture of these staple products (which once yielded large profits) will decline. Compensation for this loss, however, will be found in the manufacture of sulphuric acid, sodium sulphate, hyposulphite, sulphide and other derivatives from these sulphur salts which cannot be manufactured by the processes of either of their rivals—and even the impurities of the pyrites burned in the kilns for the lead chamber process of sulphuric acid manufacture, may be looked upon as an important source of revenue in years to come. The Leblanc alkali works will then depend more and more upon by-products, and less and less upon the staple products, soda and bleach, for their future profits. The electrolytic works, when operating a good process, and when under wise financial management, will gradually take the place of the Leblanc works as producers of bleaching powder, chlorates and other chlorine products. The manufacture of metallic sodium and of its derivatives such as cyanides and peroxides, will also most probably fall into the hands of the electrolytic manufacturers. The cost of operating the electrolytic process of alkali manufacture is, however, greater than was at first estimated, and only the best processes and best equipped works will survive in the struggle for existence.—*Electrochem. and Met. Ind.*, May.

Ferro-Vanadium.—An illustrated description of the new reduction plant of the Vanadium Alloys Company, which is the first of this kind in the world. The first steps of the process consist in crushing and leaching vanadiferous sandstone with the production of a vanadate of iron containing from 50 to 75 per cent of vanadic acid. This vanadate is then reduced in the electric furnace to ferro-vanadium.—*Electrochem. and Met. Ind.*, May.

Electrochemical Laboratory.—TUCKER.—A fully-illustrated description of the equipment of the laboratory of applied chemistry at Columbia University.—*Electrochem. and Met. Ind.*, May.

Units, Measurements and Instruments.

Selenium Photometer.—TORDA.—An illustrated description of a portable selenium photometer for incandescent lamps. It is based upon the action of light on selenium, which alters its electric resistance with variations of the intensity of light in accordance with a certain physical rule. The principal parts of the photo-

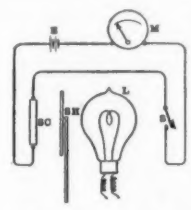


FIG. 2.—SELENIUM PHOTOMETER.

meter are: A light-tight box containing a selenium cell, a constant e.m.f. produced by dry cells, a milliammeter, a push button contact, a lampholder with flexible leads and an automatic shutter, which covers the hole of the partition placed between the selenium cell and the lamp. The lamp, fixed in the holder, is properly centered to the hole at a certain distance and faces the selenium cell. Fig. 2 illustrates the arrangement diagrammatically and shows the connections of the photometer. *S C* represents the selenium cell and *E* the dry cells. In closing the small switch, *S*, an electric current will flow through the circuit, corresponding to the dark resistance of the selenium cell, and produce a deflection on the milliammeter, *M*. If the lever of the shutter is depressed it will be opened, and the light rays passing through the hole of

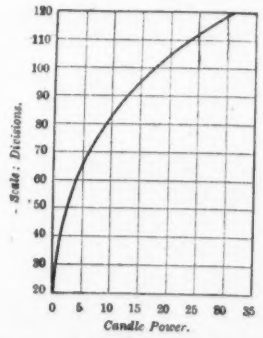


FIG. 3.—CALIBRATION CURVE OF SELENIUM PHOTOMETER.

the partition will cause a decrease of the resistance of the selenium to take place, whereby the deflection shown by *M* increases. This reading, which is a measure of the light intensity, is taken, and the screen closes automatically after a definite period and owing to the action of the clockwork remains locked for a time, in order that a certain period of rest in darkness shall be given to the selenium cell. Under normal conditions the time of exposure is about two seconds, enabling a reading to be taken easily on the dead-beat ammeter, while the period in darkness before a new reading can be taken is 40 seconds. The calibration of the scale is simple and consists in noting the deflections on the dead-beat instrument when the selenium is exposed to the effect of the source of different lamps which have been previously tested on a standard photometer. A calibration curve of a selenium photometer is shown in Fig. 3. The calibration is as permanent as in any other similar apparatus. The instrument may be used for years, though it is recommended to recalibrate the photometer about every three months and to renew the dry cells every six or nine months, while the selenium cell may be used for one or two years or more. The instrument requires a different calibration for lamps giving light of different colors.—Lond. *Elec.*, April 13.

The Cooper Hewitt Mercury-Vapor Lamp for Industrial Lighting.

The Cooper Hewitt mercury vapor lamp, invented by Mr. Peter Cooper Hewitt, of New York, as the outcome of a long study of electrical vacuum phenomena, has come into a wide commercial prominence in the past year in many interesting and important installations in the field of industrial lighting. Recent improvements in design and construction have increased its general utility, and the perfection of a new type of lamp adapted to practically all alternating-current lighting circuits has doubled the field of its possible usefulness.

The records of the performance to date of mercury lamps installed in 1904 and 1905 have demonstrated that the operating life of Cooper Hewitt tubes exceeds 5,000 hours in numerous instances. The New York Transportation Company recently renewed four tubes, each of which had been operated for more than 10,000 hours, and three of them were in fair operating condition when returned to the factory, but somewhat blackened from long service. As the only cost of maintenance in mercury lighting is for tube renewals—about one-third the original cost of the complete lamp—the demonstrated long life of the tube gives a new importance to the figures of its high efficiency. Tubes continue to operate perfectly until the vacuum becomes impaired, with no consumption of the light-giving element.

In the Cooper Hewitt lamp, a long glass vacuum tube, one inch in diameter and from 17½ to 45 in. long in the standard types, mercury vapor is excited to a high degree of incandescence by the passage of the electric current with a generation of heat that is reduced to a minimum. The radiant heat from mercury lamps, therefore, is in proportion to lighting capacity a very small part of that given off by incandescent globes or arc lamps, and this high efficiency, which means an all-important saving in power consumption, has incidentally meant also a material reduction in the temperature of work rooms in many installations in which the heat from the former lamps had been very noticeable in hot summer weather. The operating economy is well established—a candle-power of light for a power consumption of from .55 to .64 watt, proportionately one-sixth the power required by an incandescent globe, one-third that required by an enclosed arc, and one-half that required by an open arc.

In the growth of Cooper Hewitt lighting, considerable attention is being attracted to the peculiar merits of its illumination —the even diffusion of light from a luminous surface of great extent, which prevents the formation of sharply defined lights and shadows or the contraction of the pupil of the eye caused by the concentrated luminous points of other lamps; and the freedom of the mercury spectrum from red rays, attributed physiologically as the chief cause of eye fatigue in work under other artificial illuminants. Light is emitted in even intensity from every portion of the tubes, and there are no dazzling or bright moving spots. The distortion of some color values under the mercury lamp because of the absence of red rays is a matter of no consequence in the bigger part of industrial lighting, where the accurate determination of natural color values is not necessary.

The Cooper Hewitt lamp has been extensively adopted during the past two years in large machine shops and foundries, where the saving effected in power consumption has been very great; in business offices, in which the superior working quality of its light has dictated its use, apart from the consideration of its economy; in the press and composing rooms of many of the largest publishing houses in America, where the disadvantages of wiring around machinery are avoided by its use; in railroad repair shops; in drafting rooms; in pier sheds and freight houses; in textile mills, where the searching character of its light is of special value; in automobile garages and shops; in piano and organ factories, leather and paper mills, glass and rubber factories, copper and sugar refineries, hat factories, navy yards and wood working plants; and in many other industries in which its illuminating value and economy have peculiarly recommended it.

Among prominent recent installations are those at the enlarged Newark works of the Westinghouse Electric & Manufacturing Company, where 470 lamps are in use; at the new model factory of the J. L. Mott Iron Works, at Trenton, equipped with 113 lamps; at the new Baring Cross shops of the St. Louis, Iron Mountain & Southern Railroad, at Argenta, Ark., equipped with 105 lamps, and at the new Attica works of the Westinghouse Machine Company, where 86 lamps are used. Five of the largest river piers in New York are lighted by them. All the United States Government currency and internal revenue stamps are printed under their light in the Bureau of Engraving and Printing at Washington, and the Automobile Club of America will use 96 lamps in its new garage building in New York.

Other interesting installations are the lighting of the presses and make-up tables in the new building of the New York *Times*, with 48 lamps; of the offices and pressrooms of the Butterick Publishing Company, with 120 lamps; and of the polishing and action departments of the large new piano works of William Knabe & Son, Baltimore.

Notable examples of office lighting are to be seen also at the Washington Post Office, where 30 lamps, requiring 105 amp. in all, are in use in the high-vaulted mailing room, 100 by 200 ft., on the ground floor, in the place of 1,000 incandescent globes requiring 500 amp. with which the room was formerly lighted;

FIG. 1.—WASHINGTON POST OFFICE MAILING ROOM.

at the New York Post Office, where 53 lamps are in service in the carriers' and foreign money order departments; and at the New York auditing offices of the American Tobacco Company, where rooms in which several hundred bookkeepers are employed are illuminated with 48 lamps.

All but a few of the installations of the past year have been with the 300-cp Type H and the 700-cp power Type K direct-current lamps, but the 425-cp Type C lamp, for alternating-current circuits, recently put upon the market, is now being delivered for various installations where the advantages of mercury lamp lighting have not before been possible. The H lamps are generally operated in series—two in series on circuits of from 98 to 122 volts, or four in series on circuits of from 196 to 244 volts. The K lamps are operated singly on circuits of from 98 to 122 volts, and two in series on a 196-244 voltage. Series lamps are arranged with extra shunt resistances so that either lamps of a pair in series may be operated singly if desired. Each type of the direct-current lamps is run at 3½ amp., two H lamps in series on a 110-volt circuit consuming 385 watts, one K lamp installed singly on a circuit of the same voltage consuming the same power, and two K lamps in a series on a 220-volt circuit consuming 770 watts. The new alternating-current lamp consumes 275 watts on either 110 or 220-volt circuits, or .64 watt to a candle-power.

The complete Cooper Hewitt lamp outfit, in its latest form, consists of the glass vacuum tube, the holder and reflector, and the auxiliary. The tubes of direct-current lamps have a positive

electrode, of iron, at one end, and a negative electrode, of metallic mercury, in a bulb at the other end. The tubes of the new alternating-current lamps have two positive electrodes, of iron, at one end, and a negative electrode, of mercury, at the other end, the alternating current entering the vacuum by the positive electrodes and leaving by the negative electrode. The alternating-current lamps thus really operate as a converter, in applica-

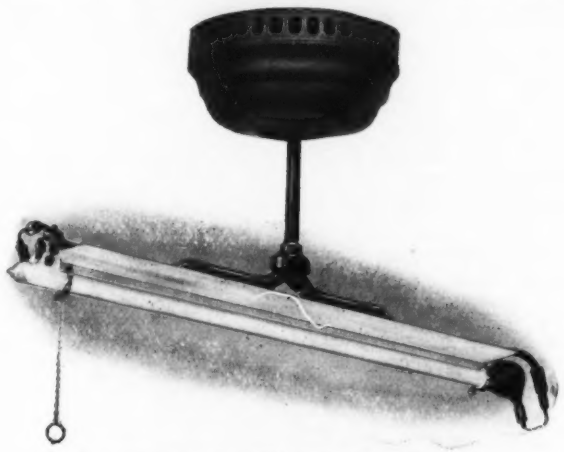


FIG. 2.—NEW ALTERNATING-CURRENT LAMP.

tion of the principle of negative electrode resistance discovered in the first invention of the mercury lamp. They are started as the direct-current lamps are started, by a temporary tilting to permit the flow of mercury from one end to the other in a small stream which momentarily bridges the vacuum, the resulting arcing of the current vaporizing some of the mercury, and the subsequent steady current flow increasing the vapor pressure and exciting it to a high degree of incandescence. Many Type H lamps are now made with a small solenoid or magnet on the suspension bar just above the holder, for accomplishing this tilting automatically when the circuit is closed. These automatic lamps

FIG. 3.—AUTOMATIC LAMP.

are used in installations in which it would be inconvenient to reach the tilting chain with the hand or a hook.

The auxiliary, consisting of two or three coils of resistance wire, an inductance coil and usually a ballast bulb to correct abnormal voltage variations, all connected in series with the tube, is enclosed in the new lamps under a neat 12-in. metal canopy, and fastened securely to the ceiling above the lamp on a plate attachment having a crowfoot into which the lamp suspension bar is screwed, thus becoming a part of the lamp fixture. The special auxiliaries for series lamps have, in addition, an automatic cut-out and shunt resistance. The new ballast bulb, an interesting feature of the auxiliary, provides economical protection against undue voltage rises by means of a fine iron wire mounted in a small glass tube somewhat resembling a miniature incandescent globe, with an inert atmosphere to prevent oxidation of the wire. This iron wire possesses to a peculiar degree the property of increasing its resistance very rapidly as its temperature is increased, so that a lamp protected by such a ballast becomes operative through a considerable range of voltage.

Self-Starters for Alternating-Current Motors.

The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., is placing on the market a complete line of self-starters

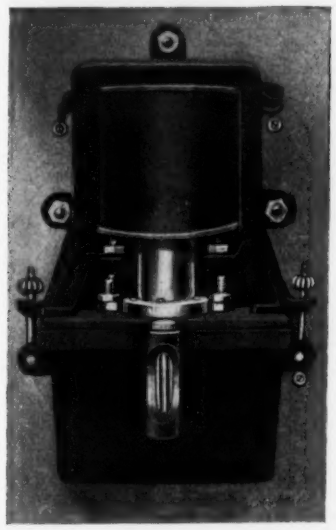


FIG. 1.—AUTOMATIC STARTER FOR SMALL MOTORS.

for alternating-current motors, several of which are shown in the accompanying illustrations. The starter shown in Fig. 1 is designed for those installations where the motor is comparatively small, and may be thrown directly across the line without starting resistance. The device consists of a double-pole, oil-immersed solenoid-operated switch, which may be controlled by either a pressure regulator or float switch, depending upon the

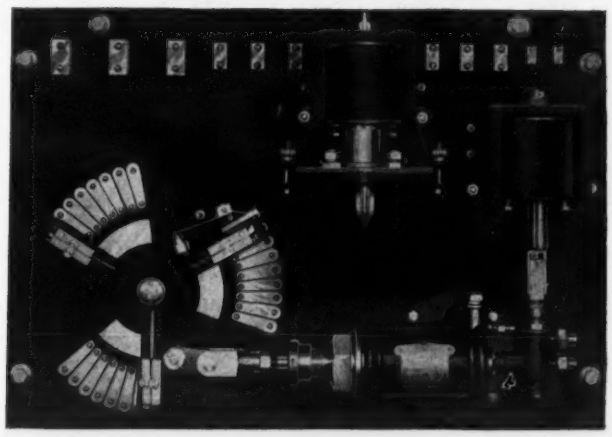


FIG. 2.—STARTER FOR LARGE SQUIRREL-CAGE MOTOR.

system used. The magnet frame is of cast iron and supports the entire switch. The plunger is laminated and is arranged to give to the switch parts a hammer blow, both for closing and opening. This starter may be used with single, two or three-phase motors of suitable type, a two-pole starter being employed for either style of polyphase motor.

For larger polyphase motors the starters illustrated in Figs. 2 and 3 are recommended. Fig. 2 shows a starter for use with a motor provided with a squirrel-cage secondary winding, resistance being inserted in the primary circuit during the starting period. The starter shown in Fig. 3 is used for inserting resist-

ance in the secondary winding of a polyphase induction motor under starting conditions. Each of these latter starters consists of a slate panel containing a double-pole, oil-immersed, solenoid-operated line switch, a resistance commutator and a resistance, a device for moving the rheostat lever and a solenoid for the

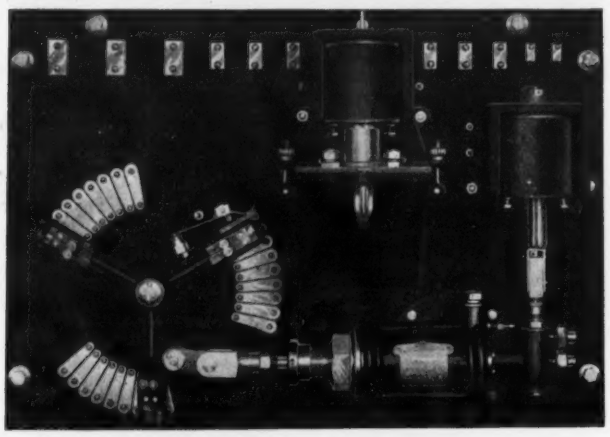


FIG. 3.—STARTER FOR MOTOR WITH FORM-WOUND SECONDARY.

control of this device. The mechanical device for operating the rheostat lever consists of a cylinder and piston arranged for operating both ways with power, and its operation is controlled by a valve, in turn controlled by an alternating-current solenoid. Water taken from the city mains may be used to operate this device. The main line solenoid switch is electrically interlocked with the rheostat lever controlling the starting resistance so that the main line circuit to the motor cannot be closed unless the lever is in the starting position, thus providing that the motor will always be started with the proper resistance in circuit.

Hydro-Electric Power for a Cement Plant.

The Washington Portland Cement Company's new plant, located in Skagit County, Washington, has its entire equipment, both for power and cement making, furnished by a single concern, the Allis-Chalmers Company, of Milwaukee. It is the intention of the building company to bring the capacity of the plant up to the capacity of 3,000 bbls. per day by adding two kilns at a time. The initial installation will consist of a complete machinery equipment for a two-kiln plant, using the dry process by means of water power and electrical drive. The raw material to be used consists of limestone and shale, the former located in deposits 1,500 ft. from the plant and the latter 500 ft., both connected by an electric road over which the material will be transported. The company has three side tracks from the main line of the Great Northern to the works. A dam across the Baker River, at a distance of a mile from the power plant, is being constructed to be connected by a flume 6 by 10 ft. from the dam to the power house. The water power, which is capable of developing 3,000 hp, will operate a 1,150-hp Allis-Chalmers twin turbine with center discs and cantilever bearings, from a fall of 50 ft. The discharge will be 250 ft. per second and the speed 360 r.p.m.

Each principal machine, such as the crusher, disintegrator, dryer, ball mills, tube mills, etc., will be driven by direct-mounted individual Allis-Chalmers motors. The auxiliary machinery, such as the elevators, conveyors and feeders, will be driven in groups by motors. As far as possible, the object has been to avoid the use of shafting belts and pulleys.

Motors of 20 hp or over are not enclosed, and the smaller motors are enclosed. The electrical equipment will be very complete. The generator, direct-connected to the turbine, will be a 750-kw Allis-Chalmers water wheel type alternator, three-phase, 60 cycles, 600 volts, excited from a direct-coupled exciter of 20 kw capacity. There will be 34 induction motors installed in capacity from 1½ to 100 hp and aggregating 870 hp. In addition to the interior equipment for the mill, an electric locomotive will operate between the mills and the shale and limestone deposits. The locomotive will haul sixteen 1½-yard cars and be capable of a speed of six miles per hour.

Producer Gas Power Plant at Worcester, Mass.

Producer gas power has recently been adopted by the Norton Emery Wheel Company for extending their present steam plant at Worcester, Mass. The horizontal double-acting heavy-duty type gas engine built by the Westinghouse Machine Company, of Pittsburg, has been adopted with Loomis-Pettibone producers using bituminous coal. The new gas engine will be 500 b.hp rated capacity, direct connected to a Westinghouse 250-volt, 300-kw generator running at a speed of 150 revolutions per minute. This unit will operate in parallel with two belted steam units, the entire plant supplying current to the various motor drives in the factory, and also for lighting. The Westinghouse engine will be of the tandem cylinder single-crank style; water jacketed throughout.

The pistons of the engine will be supported practically clear from the cylinder by front, middle, and rear crossheads. All valves are located directly in the cylinder body in a vertical line; inlet at the top and exhaust at the bottom. A sensitive governing system of the relay type, places each inlet valve independently under the direct control of the governor, by which arrangement extremely close speed regulation is secured. At the Norton Company's plant the gas used will be a mixture of two gases averaging about 125 B.t.u. per cu. ft. The producer process is intermittent, water gas being made during a short run, and "blast" or "air" being made while the producers are being blown preparatory to the succeeding water gas run. After a thorough cleansing in wet and dry scrubbers, the gas is sent to a holder of sufficient capacity to secure a thorough mixture of the alternating charges of the two different gases. In this case a 20,000 cu. ft. holder will be used—sufficient to run the engine for about 25 minutes.

Entrance Switches and Cut-Outs.

In the accompanying illustrations, Fig. 1, shows a combined switch and a plug cut-out which can be used to advantage in

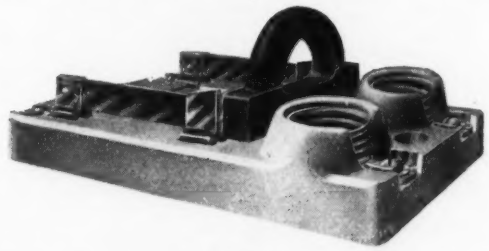


FIG. 1.—ENTRANCE SWITCH AND PLUG CUT-OUT.

many different ways where switch and fuse connections are required. Combinations of these blocks may be employed in the

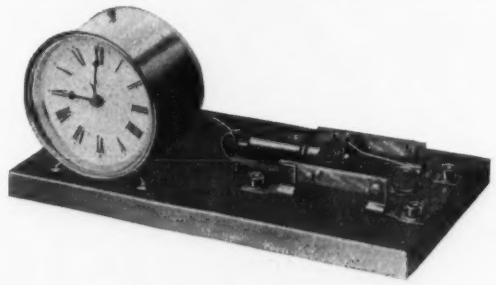


FIG. 2.—AUTOMATIC TIME SWITCH.

place of panel or tablet boards, and can be so arranged as to take off branches from one or both sides of the mains as may be required.

The automatic time switch, shown in Fig. 2, is provided with an effective quick-break spring, which eliminates the detrimental effect of continued arcing. The tripping device which is operated by the clock is automatically brought into position in closing the switch. The complete outfit, which is mounted on an enameled slate base, is easily installed and operated.

These cut-outs are built by the Specialty Manufacturing Company, Youngstown, Ohio.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Highly satisfactory reports of general trade were made last week. Retail and jobbing business is very large; building operations are extensive and crop reports are excellent. Continued favorable weather has allowed good progress in planting, the germination of crops, the enlargement of country retail trade, improved reorders for summer goods and the placing with confidence of a volume of fall orders fully equal to those of a year ago. Collections have also measurably improved. Railway earnings are large; clearings still make records for this season of the year, and the call for replacement at San Francisco is a feature helpful to trade in many lines. The coal strike still hangs fire, and minor troubles, due to unionistic movements on the lakes, and in a few cities the recrudescence in a mild form of May-day strikes, are all elements to be reckoned with. Minor developments of the week are the continued strength of nearly all staple products. Cotton has been very steady, considering the good crop reports, indications of enlarged acreage and reports of freer offerings of spots at the South. Buying of new stocks of goods for San Francisco is a feature at Chicago and other points. Building material is very active. Lumber sells at the highest prices on record at Chicago, and hardware is also in demand. Outside of the Central West pig-iron markets present irregular features, with some weakness in prices, largely in foundry grades. The United States Steel Corporation has taken all the surplus Bessemer available in the Pittsburg district for May delivery. New business in steel rails for 1907 delivery, together with additional orders for shipment, the current year, makes up a large aggregate, and further heavy contracts are pending. Demand for structural material is not especially marked, nor has business on account of replacement in San Francisco developed to any extent as yet, though one interest is said to have booked orders for 6,000 tons. The April failure report to *Bradstreet's* is very favorable, showing the smallest number of casualties and one of the lightest aggregates of failure damage of which there is record in April for 13 years past. Failures are 15 per cent fewer in number and liabilities are 22 per cent smaller than in March, while 9 per cent fewer in number and 17 per cent smaller as to liabilities than in April a year ago. The business failures for the week ending May 3 numbered only 139 against 177 in the corresponding week last year. Copper was steady to firm, with offerings moderate. Exports for the month of April were 14,778 tons, these exports being the smallest in two years. The domestic demand for lake, electrolytic and casting copper required for deliveries in June and July is in excess of the capacities of producers. Five large producers of lake and electrolytic are sold out till September. One interest closed out its June and July electrolytic at 18¾ @ 18⅞c. A round lot of lake for delivery in the last of July brought 19¼c. Casting copper, prime brands, thirty days, is held at 18½c. Eastern markets are absorbing copper in jobbers' hands at 19⅛ @ 20c for lake in good-sized lots. There is no visible supply of electrolytic, and the stocks of casting copper are down to a few casks in this market. The belief is held among the large copper consumers hereabouts that the coming week will see an upward trend in active buying and higher prices for all grades of copper.

GAS PRODUCERS.—The Power and Mining Machinery Company, Milwaukee, Wis., has recently closed contracts for its Loomis-Pettibone gas generating plants for an aggregate of approximately 12,000 horse-power. These include an installation for the Pittsburg Plate Glass Company, at their Crystal City, Mo., plant, to produce gas for operating a large Allis-Chalmers gas engine; the Norton Emery Wheel Company, Worcester, Mass., for operating Westinghouse gas engines; the Charlotte Consolidated Construction Company, Charlotte, N. C., for operating Snow gas engines in connection with street railway work, and an increase in the present installation at Sayles' Bleacheries, Saylesville, L. I., for the operation of American-Crossley gas engines. These producers will be operated on bituminous coal, but are capable of gasifying a great variety of fuels, and their adaptability to the use of different fuels without any alterations being made in the apparatus enables the users to change instantly from one to another and to use the most economical fuel that is available. Over 150,000 hp capacity of Loomis-Pettibone plants have been installed, and are now in operation in this and foreign countries. Some of the installations are at distant foreign parts, which fact attests the wide reputation of the apparatus and the confidence shown in its reliability.

SALES OF REYNOLDS-CORLISS ENGINES are reported as follows by the Allis-Chalmers Co., of Milwaukee, Wis.: The Union Stock Yards & Transit Company, of Chicago, recently purchased a 28-inch and 50-inch x 48-inch as an addition to the present power outfit. The Michigan Copper & Brass Company, of Detroit, Mich., is a recent purchaser of a 24-inch and 48-inch x 42-inch. The Union Iron Works Company, of Springfield, Mo., will install a 14-inch x 36-inch. The Drummond Packing Company, of Eau Claire, Wis., is a purchaser of a 14-inch x 24-inch. The Peninsula Lumber Company, of Portland, Ore., has purchased a 22-inch x 36-inch. The Maryland Brick & Supply Company, of Frederick, Md., will install a 14-inch x 24-inch, and the Black River Woolen Company, of Ludlow, Vt., will install a 20-inch x 42-inch.

DEMAND FOR COPPER WIRE.—The Bell Telephone Company, it is stated, has placed orders with all the domestic copper wire drawers for all the wire they can make for six months. These orders have been provided for by the purchase of 12,000,000 pounds of electrolytic copper from Western and Southwestern producers, and deliveries of the finished product are to be accelerated by double shifts in several mills in the Eastern States. The entire amount of wire is for use in underground telephone conduits in cities in which pole lines are being displaced. It is stated that additional orders will probably be placed that will consume 10,000,000 pounds of electrolytic copper to be delivered in the winter and spring of 1907. It is stated that the building of new lines is hindered the country over by the lack of copper wire.

THE CANADIAN WESTINGHOUSE COMPANY, LTD., is being called upon to supply apparatus for the operation of a number of single-phase railway lines. A recent contract is for furnishing alternating-current, single-phase railway equipment for approximately 35 miles of track, for the Windsor, Essex & Lake Shore Rapid Railway Company. For the present, five cars equipped with two 100-hp motors each, will be operated. The order covers a 500-kw, single-phase, 25-cycle generator to be installed in the main power house near Essex, together with switchboards, exciters and transformers, for operating the system. A trolley voltage of 6,600 will be used, and catenary line construction will be installed throughout.

NEW SCHENECTADY SHOPS.—Ground will be broken immediately for an extension to building No. 86 at the General Electric Schenectady plant. This shop is the turbine department. The addition will make the building 300 x 800 feet and give floor space of eleven acres, the largest of the Schenectady buildings. Contracts have been let calling for the completion of the building in ten months. The American Bridge Company has the contract for the steel work. It is said that the General Electric Company has bought a large quantity of Edison cement for its work.

COLLECTIONS OF TRADE CATALOGUES.—The Free Public Library of Newark has established a Trade Catalogue Department and will be glad to be placed upon the mailing list of manufacturers. Manufacturers are also invited to place the Library of American Institute of Electrical Engineers, 95 Liberty Street, New York, on their mailing lists.

APPARATUS FOR SAN FRANCISCO.—The Stanley-G. I. Electric Company is shipping considerable machinery to San Francisco. It sent two car loads a few days ago and it is now getting ready transformers and motors to send on to take the place of those which were destroyed in the great disaster.

ORDERS FOR EXPORT.—The American Trading Company, of New York, has ordered a 75-kw Allis-Chalmers Type I generator for re-shipment, and has also ordered a 30 x 36 Reynolds heavy-duty Corliss engine, for export, from the Allis-Chalmers Co., of Milwaukee.

VULCAN ELECTRIC HEATING COMPANY.—An important announcement to the trade and the central station industry has been made as follows by the L. P. Brown Co., of 71 West Jackson Boulevard, Chicago, who have done original and ingenious work in the electric heating field: "We take pleasure in announcing the incorporation of the business of L. P. Brown & Co., under the laws of the State of Illinois, to be known hereafter as the Vulcan Electric Heating Co. Additional capital will be used in the business and the plant and facilities will be enlarged to meet the rapidly increasing demands of our customers. The Vulcan Electric Heating Company assumes all obligations and has acquired all accounts, stock, equipment, patent and trade-mark rights and manufacturing processes of the old firm. Having established the utility of two of the most difficult applications of electric heating, by the introduction of our Vulcan electric soldering and branding appliances, we offer our goods to the trade with confidence of giving satisfaction. We will take up practical designing and engineering in connection with our electric heating specialties, and will be glad to consult with our agents or with possible customers regarding the best means of accomplishing desired results." The circular is signed by Mr. F. J. Holmes as president.

ALLIS-CHALMERS INDUSTRIAL ORDERS.—The hydraulic turbine department of the Allis-Chalmers Co., Milwaukee, reports the sale of a 2200-hp horizontal turbine, equipped with twin runners, to the Consolidated Lighting Company, of Montpelier, Vt. The outfit will also include a 60-hp exciter turbine and two hydraulic governors for the equipment. The Railway Steel Spring Company, of Latrobe, Pa., will install a 20-inch and 34-inch x 42-inch Reynolds heavy duty cross compound Corliss engine, direct connected to a 500-kw Allis-Chalmers generator. The Gayan Valley Fuel Company, of Huntington, W. Va., has recently purchased a 50-kw Allis-Chalmers generator to be installed in connection with a Chandler & Taylor engine and boiler and a Bissell switchboard. The Chandler & Taylor Co., manufacturers of high-speed engines, recently purchased a 100-kw Allis-Chalmers generator, for its engine works at Indianapolis. The Nevada Consolidated Copper Company has recently purchased nine additional Allis-Chalmers Standard induction motors and a 100-kw induction motor generator set for installation at Ruth, Nev. The E. I. Dupont Co., of Fontanet, Ind., will install two 75-kw generators. The H. C. Frick Coke Company, of Yorkrun, Pa., has ordered a 400-kw generator, and the Bates & Clark Co., of Seattle, Wash., has purchased a 100-hp standard induction motor.

PENNSYLVANIA POWER PLANT.—A company composed of Delta, Pa., capitalists has taken charge of the old Castle Fin Forge property along Muddy Creek Forks, upon which it will build a hydro-electric power plant. The property was purchased from R. F. Tabor for $12,500. Castle Fin Forge and Furnace originally was established for the smelting and working of iron in 1810, and at one time employed one hundred men. It was abandoned many years ago. The new power plant will furnish electricity for towns in the lower end of the county.

Financial Intelligence.

THE WEEK IN WALL STREET.—Prices on the stock market rallied after severe declines and enormous liquidation by pools and other large speculative holders, caused by tight money and restriction of bank credit to interests of that character. Foreign buying and absorption of stocks by bargain hunters made the recovery easy, and a rather sharp upward turn on Friday gave an appearance of decided strength. Electric securities were stronger and in most all cases closed at higher quotations than those last given. Allis-Chalmers common gained ½ point and preferred ⅛, the closing quotations being 21 and 55⅞, respectively. There was active trading in these stocks, the sales of the common aggregating 22,300 shares, and of the preferred 10,000 shares. General Electric's highest quotation for the week was 167½ and the lowest 161½, the closing quotation being 166½, which is a net gain of 3⅞ points for the week. The annual report of this company was issued Friday. It is an interesting statement, showing profits of over $7,000,000. The report is covered fully on another page of this issue. Westinghouse is recorded as having lost 6 points net at the close, the final quotation being 158. Western Union lost 1½ points, closing at 91½. A large business was done in Brooklyn Rapid Transit, 371,800 shares having been sold at prices ranging between 72 and 78⅝, the closing quotation being 78, a net advance of 4¾ points. Metropolitan Street Railway made a gain of 1⅜, closing at 112½. Interborough Rapid Transit, on the curb, closed at 218¼, after having touched 222, the closing quotation representing a net loss of 3¾ points. Mackay Companies made a net gain of 1¼, closing at 63¼. There was a decreased volume of operations on the curb market attended with extreme weakness during the first half of the week, followed by partial recoveries. Following are the closing quotations of May 8:

NEW YORK

	May 1	May 8		May 1	May 8
Allis-Chalmers Co.	20⅝	21¼	General Electric	163	168¾
Allis.Chalmers Co. pfd.	55⅛	57¾	Hudson River Tel.	...	...
American Dist. Tel.	*39	*39	Interborough Rap. Tran.	221	222½
American Locomotive	58	63⅝	Mackay Cos.	62	63¼
American Locomotive pfd.	111	113	Mackay Cos pfd.	71	71⅜
American Tel. & Cable	90	91	Marconi Tel.	...	...
American Tel. & Tel.	131	133	Metropolitan St. Ry.	109	112¼
Brooklyn Rapid Transit	74	82⅝	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	91¼	91¾
Electric Boat pfd	65	65	Westinghouse com.	140	150
Electric Vehicle	15⅛	15⅛	Westinghouse pfd.	...	...
Electric Vehicle pfd.	17⅛	17⅛			

BOSTON

	May 1	May 8		May 1	May 8
American Tel. & Tel.	132¾	134⅛	Mass. Elec. Ry. pfd	66	64⅛
Cumberland Telephone	...	...	Mexican Telephone	...	3⅞
Edison Elec. Illum.	245	247	New England Telephone	...	138
General Electric	165	...	Western Tel. & Tel.	...	12⅛
Mass. Elec. Ry.	18	18	Western Tel. & Tel. pfd.	...	...

PHILADELPHIA

	May 1	May 8		May 1	May 8
American Railways	57⅛	51⅛	Phila. Electric	7⅞	8⅛
Elec. Co. of America	11¼	11⅞	Phila. Rapid Trans.	25¾	26¾
Elec. Storage Battery	71	72⅛	Phila. Traction	98⅛	98¾
Elec. Storage Battery pfd.	...	...			

CHICAGO

	May 1	May 8		May 1	May 8
Chicago City Ry.	145	150	National Carbon	90½	89
Chicago Edison	...	145	National Carbon pfd.	118	118
Chicago Subway	...	54	Union Traction	...	...
Chicago Tel. Co.	...	115	Union Traction pfd	...	...
Metropolitan Elev. com.	26⅛	26			

* Asked

MERGER AT PORTLAND.—A consolidation of traction and other public service enterprises in the vicinity of Portland, Ore., is being carried out. It will involve between $30,000,000 and $35,000,000. New York financial interests control all of the properties in the merger. J. & W. Seligman & Co. have owned the street railway system of the city for some time past and about a month ago came into control of the interurban system, which operates along the Williamette Valley within a radius of forty miles of the city. E. W. Clark & Co. and Pratt & Co. control practically all of the other public service enterprises producing or using electricity in this territory, and it is their properties that are to be united with the Seligman holdings. The Portland Consolidated Railway Company, which operates the traction system of the City of Portland, has franchises running to 1933. Some of its power is obtained from the Portland General Electric Company, which will be one of the parties to the combination. The Oregon Water Power & Railway Company is another of the companies included. Mr. W. S. Barstow has been consulting engineer on a large part of the work.

DIVIDENDS.—Directors of the Washington Railway & Electric Company have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable June 1. The Philadelphia Electric Company's directors have declared the regular semi-annual dividend of 2½ per cent, payable June 15. Directors of the Pratt & Whitney Co. have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable May 15. Directors of the Niles-Bement-Pond Co. have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable May 15. The Washington Railway & Electric Company has declared its semi-annual dividend of 2½ per cent on its preferred stock, payable June 1. The Philadelphia Electric Company has declared its regular semi-annual dividend of 2½ per cent, payable June 15.

MERGER IN BALTIMORE.—It is stated that negotiations are well advanced for the merger of the Consolidated Gas, Electric Light and Power Company with the Consolidated Gas Company of Baltimore. The merger of these two companies has been made possible by recent act of the Legislature of Maryland, permitting such a merger, and it is understood that a plan is now under consideration with this object in view.

TELEPHONE MERGER.—The Keystone Telephone Company, of Philadelphia, has acquired control of 80 per cent of the stock of Eastern Telephone & Telegraph Company, of Camden, N. J. The Eastern Telephone Company has 2,500 subscribers and the share capital has a par value of $250,000.

CHICAGO LIGHTING MERGER. The Commonwealth and Chicago Edison Companies seek authority from the city to merge with any similar company now existing or that may be organized in Cook County.

GENERAL NEWS.

Construction News.

ANNISTON, ALA.—The House of Representatives has passed the bill authorizing Roswell H. Cobb and associates, constituting the Coosa River Power & Development Company, permission to construct the dams and the contemplated power house at Lock 2 on Coosa River. It is proposed to furnish power in Anniston, Gadsden and Birmingham.

HOT SPRINGS, ARK.—The Hot Springs Telephone Company will expend $20,000 for putting in conduits.

MERRYVILLE, CAL.—The General Electric Company has purchased a tract of land in this city upon which it will erect a large plant, which is to be its permanent headquarters.

PALO ALTO, CAL.—John J. Lewin, superintendent water works and light plants, writes that plans and specifications have not yet been completed for the improvements proposed.

SAN FRANCISCO, CAL.—The Home Telephone Company has been granted a franchise for a telephone system in this city, and its bond for $250,000 has been approved by the board of supervisors. The company binds itself to expend $4,000,000 in two years in establishing its system.

SAN FRANCISCO, CAL.—The department of electricity, acting in conjunction with the joint emergency committee on light, power and telephone service, of which Rudolph Spreckles is chairman, is busy passing on applications for permits for the resumption of lighting and power plants. Thus far thirty-four permits have been granted. Most of these are for operation of motors in the district close to the Mutual Electric Company's power station, on the water front, from which plant they have arranged to obtain power, or in the Mission district, in the neighborhood of Folsom, Harrison, Sixteenth and Eighteenth Streets, where power is obtainable from one of the power stations of the San Francisco Gas and Electric Company.

NEW HAVEN, CONN.—The Southern New England Telephone Company will lay about forty miles of underground cable in the State this year.

PUTNAM, CONN.—The town has made a contract with the Putnam Light & Power Company to light the streets for one year from June 1, 1906, for $416.16 per month. The company will soon extend its line to South Woodstock.

WINDSOR LOCKS, CONN.—The Windsor Locks Electric Light Company has secured a controlling interest in the Thompsonville Electric Light Company, of Thompsonville. As soon as the necessary changes can be made in the plant at Windsor Locks the production of electricity at the Thompsonville plant will be discontinued, and that plant will be used as a sub-station. Ultimately it is the intention of the promoters to organize a company that will combine the powers of the charters of the various light and power companies in the towns of Windsor Locks, Enfield and East Windsor. It will install a 175-kw Allis-Chalmers type "A" generator and a 6-kw exciter, recently purchased from the Allis-Chalmers Company, of Milwaukee.

WINDSOR LOCKS, CONN.—The George P. Clark Company, manufacturers of trucks and rubber rolls, has decided to equip its entire plant with electric power to be generated on the premises with steam as the motive power. An 80-hp Slater engine of the Corliss type has been purchased and the contract has been let for a 90-kw, three-phase induction motor, 240 volts and a 1.5-kw exciter to the Stanley-G. I. Company of Pittsfield, Mass. In all, 23 motors will be used, ranging in power from one to 15 hp. The new generator will also light the factory. The work is being done under the direction of George E. Clark, secretary and treasurer.

WASHINGTON, D. C.—Bids will be received until May 22 by the Treasury Department (H. A. Taylor, acting secretary) for supplying to the United States buildings under its control east of the Rocky Mountains, as the requirements of the service may demand, during the fiscal year ending June 30, 1907: Electrical fittings and materials; also electric wires and cables.

WASHINGTON, D. C.—Bids will be received until May 22 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards, Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 532—Incandescent lamps, Gonda cells, wire, electrical supplies, sheet copper, etc. Schedule 533—Crane and hoist, bar steel, sheet copper; also May 29 to furnish at the Navy Yards, Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 538—Arc and incandescent lamps, electrical supplies, etc. Schedule 541—Electrical equipment for launches, electric drill, track trolleys, tool steel, copper pipe, etc. Schedule 542—Electrical supplies, pumps, steel cement, copper pipe, etc. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

BRADENTOWN, FLA.—The Manatee Light & Traction Company has recently purchased of the Allis-Chalmers Company, of Cincinnati, Ohio, one 150-kw and two 115-kw Allis-Chalmers generators and three 4-kw exciters.

WASHINGTON, GA.—The plans for the development of Anthony Shoals, 18 miles from the city, is progressing favorably, and power of from 25 to 30,000 hp will be developed. Thomas Ludlow is city engineer.

SAVANNAH, GA.—The Savannah Lighting Company has contracted with the Standard Underground Cable Company of Philadelphia to do the underground wiring in the new conduit system which will soon be completed.

SANDPOINT, IDAHO.—The City Council has granted Mr. Humbird a franchise for an electric light plant.

PAYETTE, IDAHO.—The Council has granted the Idaho Light & Power Company a franchise for an electric light and power plant.

WEISER, IDAHO.—The Interstate Electric Power Company has been organized to construct a dam and power plant at Eagle Rock on Snake River, capable of developing 20,000 horse-power. Mr. Wiley is chief engineer.

MILAN, ILL.—S. S. Davis is interested in the construction of a dam on Rock River for developing electric power.

CAIRO, ILL.—The Cairo Electric & Traction Company is planning extensive improvements to its power plant on Ninth Street.

SHELBYVILLE, ILL.—The Central Union Telephone Company and the Mutual Telephone Company have been consolidated and will be operated under one management.

ELGIN, ILL.—The Elgin & Bloomington Railroad Company has decided to change its name to the Chicago & Elgin Electric Railway Company, and to increase its capital stock to $800,000.

FAIRBURY, ILL.—The Fairbury Electric Light, Heat & Power Company has consolidated with the Chatsworth Electric Light Company and new machinery will be purchased and the plant remodeled.

AURORA, ILL.—The City of Aurora has contracted with the Western Electric Company for a 300-kw. two-phase alternating-current generator and 300 series enclosed alternating arc lamps for the new municipal lighting plant.

CHICAGO, ILL.—Bids will be received until May 16 by the South Park Commissioners for furnishing and delivering within the South Park system, 130,000 electric light carbons and 10,000 feet electric light cables. E. R. Shumway is secretary.

EVANSTON, ILL.—The North Shore Electric Company, of Evanston, Ill., has filed a certificate of increase of authorized capital stock from $2,000,000 to $3,000,000, preparatory to purchasing outright the Lagrange Water, Light & Power Company, and to complete unfinished construction work started by that company. Only $500,000 of the new stock will be issued at present.

CAMP POINT, ILL.—The Camp Point Electric Light & Power Company has recently installed a new 75-kw, 60-cycle, revolving field General Electric generator; also new transformers and Westinghouse meters. The present owners have offered the plant for sale. The village board prefers to have the plant run by private parties, but will submit the proposition to the citizens to vote on municipal ownership, providing the plant is not sold soon.

FORT WAYNE, IND.—The National Telephone Company and the Home Telephone Company have been consolidated under the name of the Home Telephone Company.

FORT WAYNE, IND.—The Fort Wayne & Springfield Railway Company has increased its capital stock from $300,000 to $500,000. The company will build an electric railway from Ft. Wayne to Springfield.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company has recently purchased a 150-kw Allis-Chalmers belted generator, 2,300 volts, 2 phase, 60 cycles, with direct-connected exciter.

BLUFFTON, IND.—It is reported that steps have been taken to build an air line railway from Bluffton to Norwalk, Ohio. The road will connect with a number of Ohio lines at Norwalk. It is stated that the Riggs & Sherman Company, of Toledo, Ohio, will make the surveys.

RUSHVILLE, IND.—Plans have been prepared for the installation of a modern electric light plant in this place. Alvin Middleton and others will construct a building and are ready to correspond with dealers in material and equipment for the installation of a light plant. It is the intention to begin work at once.

INDIANAPOLIS, IND.—The "Pasadena Park Association" is having plans prepared for the construction of apartment buildings, including a central electric light, steam and hot water plant for service to these buildings. The Pasadena Park buildings will furnish homes for 5,000 people. Geo. V. Bedell is the architect.

RICHMOND, IND.—Prof. Matthews, head of the department of Electrical Engineers in Purdue University, has been secured to make an examination of the building, engines, generators and other apparatus of the municipal lighting plant, for the purpose of ascertaining the actual depreciation of the plant, now about to be sold.

INDIANAPOLIS, IND.—The Moore-Mansfield Construction Company, of Indianapolis, has been awarded the contract to complete the Indian-

apolis, Crawfordsville & Western Traction Company's line between this city and Crawfordsville. It is rumored that the McKinley syndicate of Illinois has purchased the line, and that it is to be part of the through line from Indianapolis to Peoria.

IDA GROVE, IA.—The Farmers' Mutual Telephone Company has been organized by A. C. Garner, Robt. Todd and others to put in telephone lines throughout the county.

CEDAR RAPIDS, IA.—The New State Telephone Company will string copper wire from Correctionville to Carroll, which will improve the service between Sioux City and Des Moines.

MASON CITY, IA.—The Western Electric Telephone Company contemplates making extensive improvements to its system, involving an expenditure of about $200,000. All the present lines will be rebuilt with copper and iron wire, and several new lines will be built. A new equipment will be installed in the head office in this city.

FORT DODGE, IA.—Child, Hulswit & Co., of Detroit, Mich., has purchased the property of the Fort Dodge Light Company, of this city, and a company has been organized to take it over with a capital stock of $300,000, and an authorized bond issue of $400,000, of which $225,000 has been issued.

HAYS CITY, KAN.—Justus Bissing contemplates installing a new dynamo and making other changes and improvements to his electric light plant in this city.

INDEPENDENCE, KAN.—It is reported that A. C. Smith and a company of capitalists will organize a company for the purpose of erecting an electric light plant, which will cost about $10,000.

OSAGE CITY, KAN.—It has been decided by the Council that the site of the electric light plant here will not be changed. The enlarging of the plant, the purchase of new machinery, the selection of lamps and many construction details are now receiving consideration. The committee has decided to invite Morris Dunsworth, superintendent of the Emporia electric light plant to make an investigation of local conditions and needs. Unless some unexpected complications should arise the new light plant for this city should be ready for use by July 1.

PADUCAH, KY.—The Paducah Light & Power Company, Inc., has recently purchased a 500-kw Allis-Chalmers generator.

LITCHFIELD, KY.—W. W. Mauzey, city clerk, writes that R. L. Moorman, of Litchfield, has secured the franchise for an electric light plant.

DANVILLE, KY.—Bids will be received until May 15 by the Commissioners of the Kentucky School for the Deaf at Danville for wiring the buildings and installing an electric light plant in the said school. Augustus Rogers is superintendent.

AUGUSTA, ME.—The Kennebec Light & Heat Company has recently purchased from the Westinghouse Electric & Manufacturing Company a 500-kw turbo-generator set, and a condensing apparatus from the Deane Steam Pumps Works. W. H. Williams is superintendent.

BANGOR, ME.—The Bangor Railway & Electric Company contemplates making extensive improvements in its power plant at Veazie and the substation on Park Street; also to improve the facilities for transferring current from the main lower power station to the street railway in the city and to the Bangor & Northern. The cost is estimated at $30,000.

CUMBERLAND, MD.—The three electric railway companies now operating in Alleghany County—namely, the Cumberland & Westernport Electric Railway Company, the Westernport & Lonaconing Railway Company and the Midland & Frostburg Electric Railway Company, embracing thirty-two miles between Cumberland and Westernport—have been consolidated. The consolidated company will be known as the Cumberland & Westernport Electric Railway Company. DeWarren H. Reynolds has been elected president; D. P. Hartzell, secretary.

LINDEN, MASS.—A petition is in circulation in North Revere for the extension of gas and electricity to that part of the town.

PITTSFIELD, MASS.—The Pittsfield Electric Company will put 90 new Stanley arc lamps in place of the street lamps now in use in different parts of the city.

CAMBRIDGE, MASS.—At a recent meeting of the Common Council a committee was appointed to investigate the question of establishing a municipal electric lighting plant.

SOUTH LAWRENCE, MASS.—The Boston & Maine Corporation has recently installed a large dynamo in its car shops for the purpose of operating the machinery by electricity.

ACTON, MASS.—At a recent meeting the committee on public lighting reported a bill to permit the American Woolen Company, of New Jersey, to furnish light and power to the town of Acton.

GREAT BARRINGTON, MASS.—A meeting of the voters of the fire district will be called May 10 to consider the lighting question, and to make satisfactory arrangements for a suitable system during the year.

SALEM, MASS.—The Salem Electric Lighting Company will build an office building and store house on Lafayette Street. The company also will install an additional Mackintosh & Seymour compound engine of 1,500 hp and a 1,000-kw General Electric generator.

NORTH EASTON, MASS.—The present contract of the North Easton Village District for lighting the streets expires the first of next August. Many of the residents and business men are in favor of installing a municipal electric plant. The amount appropriated for the lighting and maintaining of street lights in the district is $3,900.

BROCKTON, MASS.—The question of municipal lighting is now being investigated by the city. It is claimed that the city could buy the local electric lighting and gas plants for about $800,000, and there are many who are in favor of the city buying the plants. Meanwhile the electric light company holds a contract for street lighting until 1910.

CHICOPEE, MASS.—The Chicopee Manufacturing Company has decided to have another power plant erected at the lower end of the canal. The new plant will be erected over the wasteway near the lower end of the canal and will consist of two 1,000 hp turbines directly connected to a generator made by the General Electric Company, which will be located in the new power house.

WORCESTER, MASS.—The Mayor has accepted the terms made by the Worcester Electric Light Company to furnish arc lamps to the city for 25 cents per night without a contract. Beginning May 1 the price will be $91.25 per arc lamp per year. The former price was $109.50. The company contemplates putting in new enclosed arc lamps in place of the open arcs now in use.

ATHOL, MASS.—The Greenfield Electric Light & Power Company has substituted for its flat rate, 15⅝ cents per kw-hour for lighting, a sliding scale of rates which will give a reduction of 12.6 per cent on its entire business. Beginning with those whose bills total 16 kw-hours or less, the rate will be 15 cents, ⅝ cent reduction. All bills of 600 kw-hours will be at a rate of 10 cents, and charges over this amount will be billed at eight cents. The company will still keep in force its discount of 10 per cent on all bills in excess of $1.50, provided payment is made before the 10th of the month.

HASTINGS, MICH.—The Thornapple Electric Company has changed its name to the Thornapple Gas & Electric Company.

FLINT, MICH.—A company has been formed here by H. R. Loranger, of Flint, and R. O. Hart, of Flushing, to construct electric light plants at Flint and Flushing.

MEMPHIS, MICH.—The Council has granted a franchise to S. R. Lester, of Sandusky, for the erection and operation of an electric lighting plant and a system of waterworks.

DETROIT, MICH.—The Home Telephone Company has been given a permit to lay six-duct conduit on Howard Street. This is the initial step in the construction of its $3,500,000 system.

HASTINGS, MICH.—A petition has been made to the City Council for a franchise for an electric railway to run from Grand Rapids to Battle Creek. John E. Moore is promoting the proposed line.

SAGINAW, MICH.—An effort is being made to organize a company for the purpose of building an electric railway from Saginaw to Farmington, connecting at Farmington with the Detroit United Railway for Detroit.

SAGINAW, MICH.—A committee of business men from the towns interested recently met in Saginaw and made arrangements for the survey of the proposed electric railway from St. Johns to St. Louis. All the towns along the line will contribute toward the construction of the road.

IONA, MICH.—The Board of Supervisors has granted the Michigan Power Company a franchise to build a dam across Grand River in Danby Township. The company also proposes to erect at some future time a power plant on Grand River at Dudley. O. Watson, of Coopersville, and L. E. Rowley, of Lansing, are interested.

LANSING, MICH.—The new building for the Commonwealth Power Company has been completed, and the equipment is now being installed. It consists of three rotary converters of 300-kw capacity each, with transformers and switchboards. The company will furnish power for the Lansing-St. Johns line as soon as the station is completed.

NEWAYGO, MICH.—The Grand Rapids & Muskegon Power Company has commenced work on its new dam, to be built near Croton, six miles above Newaygo. This dam is to be 35 feet high and will have eight flood gates, eight wheels and generators double the capacity of the Rogers dam recently built near Big Rapids. It is expected that it will be a year before the dam is completed.

BAY CITY, MICH.—The Bay City Traction & Light Company has submitted the following proposition to the Council to light the streets of the city: If the company is allowed to use the present pole and wire lines of the city and avail itself of the city's privilege to use poles of other companies for public service, it will install modern high-class lamps rated at 2,000 candle-power in place of the old style open arc lamps now in use, and any such additional lamps as the city may order during the term of the contract to be agreed upon, for $50 per lamp per year on moonlight schedule, or $60 per lamp per year on an every night schedule, subject to a deduction for outages equal to twice the rate received per lighting hour. At the expiration of the contract, which shall be 10 years, the city may at its option purchase the lamps and wire extensions at a value to be determined by agreement or arbitration. The proposition has been referred to the committee on electric lighting.

GREENBUSH, MINN.—H. Fant, of Thief River Falls, Minn., will install a local telephone exchange.

ALBERT LEA, MINN.—The Albert Lea Light & Power Company has filed an amendment to its charter increasing its capital stock to $400,000.

MANKATO, MINN.—The Northwestern Telephone Exchange Company contemplates an expenditure of about $15,000 for improvements to the local system.

ST. PAUL, MINN.—The City Council has passed the ordinance requiring all wires to be placed underground in the business portion of the city this year.

ST. PAUL, MINN.—The Twin City Telephone Company has transferred all of its property to the Tri-State Telephone & Telegraph Company for a consideration of $4,000,000.

ST. PAUL, MINN.—The Western Gas & Supply Company, of Chicago, will build an additional dam for power on the Apple River, located a mile below the one now in operation near Somerset, Wis.

LITTLE FALLS, MINN.—The Little Falls Power Company has let contracts for the development of an additional 2,500 horse-power at the electric station. S. Morgan Smith Company, of York, Pa., will furnish two water wheels. A new electric generator will also be installed.

EVELETH, MINN.—The Mesaba Telephone Company has let the contract for the construction of its building in this town to cost $4,000. The company will also expend $10,000 in rebuilding its lines, substituting aerial cable in place of wire, and other new equipment. F. E. Lister is district superintendent.

STANBERRY, MO.—The Stanberry electric light plant, which was owned by A. C. Frisbie and T. D. Hussey, has been sold to the General Public Service Company, of Kansas City, of which George S. Marshall is president.

LIVINGSTON, MONT.—J. L. Bright has secured the contract for lighting the streets for five years at $90 per light per year.

HELENA, MONT.—O. H. Crumb & Co. have applied for a franchise for a local telephone exchange.

HELENA, MONT.—The dam which is being constructed on the Missouri River, 18 miles above Helena, is rapidly nearing completion. The dam will develop about 25,000 horse-power, which will be transmitted to Anaconda, Butte and Helena, for use in the mines, smelter and manufacturing plants. The pole line has been completed and everything is in readiness to use the electricity as soon as the power plant is completed. The plant is expected to be in operation in July.

GRAND ISLAND, NEB.—At a recent election the citizens voted to issue bonds for the construction of a light and power plant in connection with the water works system.

PLATTSMOUTH, NEB.—The Nebraska City Telephone Company will spend $25,000 in improvements this summer. The lines between this city and Lincoln are being replaced with copper wire.

FALLS CITY, NEB.—The Falls City Telephone Company has reorganized and increased its capital stock. The new company will be known as the Southeastern Nebraska Telephone Company, with $100,000 capital stock. It will take over the business of the Falls City Telephone Company and will establish a through toll line from Kansas City to Lincoln and Omaha.

ROCKAWAY, N. J.—The Council has decided to issue $30,000 lighting bonds.

PASSAIC, N. J.—The Keystone Electric Company has increased its capital stock from $10,000 to $100,000.

NEWARK, N. J.—The Common Council on May 14 appointed a committee to act in co-operation with the Board of Public Works in an investigation into the question of the establishment by the city of an electric light plant to supply lights for the streets; also the public buildings of the city. It is stated that it has been decided not to install an independent electric lighting system in the new City Hall.

YONKERS, N. Y.—The city has appropriated $300,000 to establish a municipal lighting plant.

OSWEGO, N. Y.—A franchise has been granted to the Empire State Telephone Company to build subways.

PHELPS, N. Y.—The village trustees have granted J. C. Howes' Sons Electric Light Company permission to operate an electric light plant for a period of 20 years.

WATERVLIET, N. Y.—The Hudson River Telephone Company has purchased a plot of land on First Avenue and will soon construct an exchange building. Fuller & Pitcher are the architects.

PEEKSKILL, N. Y.—The Peekskill Lighting & Electric Company, capitalized at $1,400,000, and furnishing gas and electricity to Peekskill, and operating ten miles of electric railway, has been acquired by F. A. Stratton, of Westchester County, who is president of the Northern Westchester Lighting Company.

ROCHESTER, N. Y.—The Whitley lighting bill was unanimously approved by the Mayor and the sixteen aldermen who attended the special council meeting held April 30. This is the bill whereby it is hoped Rochester will obtain competition in electric lighting. The Mayor will advertise the new lighting contract about June 1.

SYRACUSE, N. Y.—The Central New York Telephone Company has let contracts for the construction of twenty miles of subways, involving an expenditure of more than $200,000. The Warner-Quinlan Asphalt Company was awarded contracts for about sixteen miles of the work, and R. F. Lewis for the remaining four miles. The work will commence at once. H. F. Stevens is general manager.

NEW YORK, N. Y.—Bids will be received until May 29 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yard, New York, N. Y., naval supplies as follows: Schedule 538—Arc and incandescent lamps, bells, etc. Schedule 541—Electrical equipment for launches, tool steel, copper pipe, etc. Schedule 542—Electrical supplies, pumps, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

GLENS FALLS, N. Y.—The Hudson River Electric Power Company has secured an additional property for the development of electrical energy in the purchase of the Zenas Van Dusen saw mill property on the north side of the Hudson River near Glens Falls. The plot comprises over a hundred acres with a river frontage of three miles. The purchase carries the right to the surplus water of the river, and it is estimated that under the modern methods of hydro-electrical development 5,000 hp can be obtained. The property is to be improved at once.

AMSTERDAM, N. Y.—The Hudson River Electric Power Company is constructing a new sub-station at Amsterdam. This station is designed to meet the requirements of the increasing business at Amsterdam and to handle the power coming from the water-power stations at Spier Falls, Mechanicville and Schoharie Falls. The plans call for a brick and steel structure, with concrete foundations, 127 by 91 feet and 48 feet high. The high tension lines from the power stations at Spiers Falls, Schoharie Falls and Utica will enter the station. The installation contemplates caring for 10,000 horse-power.

MINNEWAUKON, N. D.—J. Mahany, Fred. Snore and others are interested in the construction of an electric light plant.

AVONDALE, OHIO.—A building permit has been issued for a $5,000 power house for the Jewish Hospital.

GEORGETOWN, OHIO.—The Georgetown council has granted a franchise to the Independent Telephone Company.

CLEVELAND, OHIO.—The Rush Creek Telephone Company has increased its capital stock from $5,000 to $10,000.

SHARON, OHIO.—The Shenango Valley Traction Company is planning to extend its line from South Sharon to New Castle.

ASHTABULA, OHIO.—An election will soon be held to vote on issuing $50,000 bonds for rebuilding the electric light plant.

PORTSMOUTH, OHIO.—Fire at this place last week destroyed cables of both the Bell and independent telephone companies, throwing their systems out of service.

HAMILTON, OHIO.—A 300-hp engine was wrecked recently in the Hamilton municipal electric light plant. The accident was caused by a defect in the condenser system.

OBERLIN, OHIO.—The Oberlin Gas & Electric Company has just placed contracts for machinery to double the capacity of its plant, to meet the requirements of its increasing business.

BOWLING GREEN, OHIO.—The car house of the Lake Erie, Bowling Green & Napoleon Railway was recently destroyed by fire, causing a loss of about $50,000. The power station adjoining it was saved.

MEDINA, OHIO.—The Medina County Farmers' Telephone Company has increased its capital stock from $10,000 to $25,000. A large number of farmers all over Medina county are installing telephones.

MARIETTA, OHIO.—Col. A. E. Boone, who has promoted a number of roads in Southeastern Ohio, states that he has arranged with a New York syndicate for financing the proposed line between Pomery and Belpre.

BENWOOD JUNCTION, OHIO.—The Baltimore & Ohio Railroad Company is planning to double the capacity of its shops at Benwood Junction, and will erect a plant to furnish electricity for lighting and power.

RICHWOOD, OHIO.—The Board of Trade at Richwood has offered to secure a right of way and grade it providing the Delaware & Magnetic Springs Railway Company will build an extension to that place and operate cars this summer.

BELLEFONTAINE, OHIO.—The Central Union Telephone Company is preparing to run toll lines to all parts of Logan County and will establish a number of small exchanges. Important improvements are to be made at the Bellefontaine exchange.

CINCINNATI, OHIO.—The light committee of Newport has recommended the installation of 32 additional arc lamps and eighteen 32-cp incandescent lamps. Current is furnished by the Cincinnati, Newport & Covington Traction & Light Company.

TORONTO, OHIO.—The East Liverpool Traction & Light Company has obtained the right of way for a double-track extension of the road from Wellsville to Yellow Creek Junction through this city, where a connection is to be made with the Steubenville & Ohio Valley Railroad Company.

FOSTORIA, OHIO.—The City Council has decided to correspond with prominent manufacturing concerns with a view to determining the cost of installing a municipal plant for arc and commercial lighting and for steam heating. A proposition to bond the town will then be considered.

XENIA, OHIO.—The Citizens' Light & Power Company, which was formed some time ago, has started its plant and is now supplying a number of residences and business houses. It gives a day service, something that the competing company has never given, and the service is much appreciated.

CLEVELAND, OHIO.—The lowest bid opened on May 4 by the Board of Public Service for a turbine, engine and generator for the municipal electric light plant, to be established by the city in the gully near the South Brooklyn bridge, was submitted by the Allis-Chalmers Company, of Milwaukee, Wis., for $16,172.

ELYRIA, OHIO.—C. Clough and H. Schibley are securing right of way for an electric railway from Elyria to South Amherst and North Amherst touching a number of large stone quarries. In addition to handling passenger service, cars especially designed for the purpose will transfer stone to the steam railroad, passing through Elyria.

COLUMBUS, OHIO.—The Columbus Citizens' Telephone Company has placed orders with the Automatic Electric Company of Chicago for a

large amount of additional equipment for the automatic exchange in operation in Columbus. The company now has 7,500 switches in operation and will increase its capacity to 10,000 as soon as possible.

MANSFIELD, OHIO.—The power plant of the Mansfield Electric Railway, Light & Power Company was practically destroyed May 2 by the bursting of the fly wheel, causing a damage of from $75,000 to $100,000 and leaving the city for the present without power for the local street railway and the Mansfield & Shelby interurban line. The city will be without incandescent or arc light or power for electric motors for several days.

MASSILLON, OHIO.—The Massillon Light, Heat & Power Company has closed a contract with the Board of Public Service to light the streets of Massillon for ten years from May 1, 1906, with 180 Wood enclosed-arc 460-watt lamps to burn on "moonlight—all dark hours" schedule at $69.50 each per year; also for 50 graphitized filament 50-cp incandescent lamps to burn in series with the street arcs on the same schedule at $12 each per year.

TOLEDO, OHIO.—The electric light committee of the Council has been instructed to advertise for bids for street lighting. Bids will be received for terms of three, five and ten years so that a short time contract may be made if desired, in order that the municipal light project may be revived. The Toledo Gas, Electric & Heating Company is expected to bid in opposition to the Toledo Railways & Light Company, which has held the contract for a number of years.

CINCINNATI, OHIO.—Local telephone rates will be reduced after July 1. To bring about necessary changes, the local Bell Company will have to spend about $75,000 and increase its number of employes in the operating department ten per cent. The City Council has indefinitely postponed action on ordinances whereby certain independent telephone companies seek franchises. This action is on the theory that the present telephone service is ample and satisfactory and that the rates are fair. This is equivalent to refusing franchises to the independent companies.

TOLEDO, OHIO.—Mr. A. K. Detwiler, of Toledo, with associates, has been awarded a franchise for an independent telephone system at San Francisco. Before the disaster the city had agreed to give the contract to the highest bidder, but it was thought that the almost total destruction of the city would prevent any definite action at this time. Mr. Detwiler, however, succeeded in getting the council together with the results mentioned. As the Bell company's plant was destroyed, the new independent company will have an even chance with its rival in the solicitation of business.

CANAL FULTON, OHIO.—The Massillon Light, Heat & Power Company has closed a contract and is operating under the same, to light the streets of this town, 9 miles distant from Massillon for ten years, with 22 Wood enclosed-arcs, 460-watt lamps to burn on "moonlight—all dark hours" schedule at $70 each per year; also 7 graphitized filament 65-cp incandescent lamps to burn in series with the street arcs at $21 each per year. Power to operate the Canal Fulton service is furnished from the central station in Massillon. This latter service went into operation April 17.

PORTLAND, ORE.—The Pacific States Telephone & Telegraph Company will build three new sub-stations to relieve the congestion of the telephone service on the East Side. Plans are now being made for the buildings, which will cost about $25,000 each. The company will also spend about $200,000 in extending its system of underground cables throughout the city streets.

PORTLAND, ORE.—The Mount Hood Electric Company proposes to construct and sell to the city of Portland for the sum of $1,250,000 a water-power plant, the initial installation of which shall be capable of developing 10,000 horse-power, with 15,000 additional horse-power for future increase of plant. To install this additional horse-power will cost but $400,000. An additional $250,000 in bonds should be provided for the construction of the distribution service within the city limits. The Mount Hood Electric Company will enter into a contract with the city to pay to the city for the surplus current which will not be used by the city, the sum of $60,000 per annum, leaving the net cost of the plant to the city of Portland, including interest upon bonds and operating expenses of $15,000 per annum, or a saving to the city of $65,000 per year, which sum deposited in a sinking fund will pay off the bonds issued in 30 years. Under the proposal of the Mount Hood Electric Company the number of arc lamps in the city can be increased from 1,156 to 5,000 without additional cost to the city for the current supply. It will enable the city to light every public place and building without additional cost, excepting wiring for the same.

MEDIA, PA.—Plans have been made for an exchange building in this town for the Bell Telephone Company.

MARION CENTRE, PA.—The Farmers' Telephone Company contemplates increasing its capital stock from $15,000 to $25,000.

HAMILTON, PA.—The Lehigh Valley Transit Company contemplates the construction of a new power house on Front Street north of the city.

PITTSBURG, PA.—The Allegheny County Light Company has recently purchased twelve more Allis-Chalmers induction motors, ranging from 7½ to 15 hp and an 18-hp type "N" direct-current motor.

MECHANICSBURG, PA.—The Heisey Electric Company, of York Haven, has secured the contract for lighting Mechanicsburg at $55.92 per year per arc lamp, and $15 per year per incandescent lamp.

YORK, PA.—The new management of the York Street Railway and allied companies is planning to extend its suburban lines. It is stated that the loop from Bittersville to Hellam will be constructed during the summer.

SUNBURY, PA.—The Middlecreek Electric Company has purchased the steam plant of the Northumberland Electric Light, Heat & Power Company. The Middlecreek Company will also light Selinsgrove and Middleburg, Pa. George W. Wagenseller is secretary.

ALLENTOWN, PA.—Engineer H. V. Hunt estimates the cost of constructing a municipal electric light plant to be located at and operated in conjunction with the Crystal Spring pumping station, for the purpose of lighting the streets and public buildings, at $140,000.

WASHINGTON, PA.—A contract has been made with the Washington Electric Light & Power Company for lighting the borough for a term of five years at $70 per year per arc lamp, of which there are 184. Under the old contract the price was $83 per arc lamp.

IRWIN, PA.—Pittsburg, Irwin and Greensburg men have applied for a charter for the Pittsburg, McKeesport & Westmoreland Railways Company. This road is intended as a connection with the line from Irwin to McKeesport, and the Manor Valley road from Manor to Irwin and Herminie.

PHILADELPHIA, PA.—The Keystone Telephone Company of this city has obtained control of the Eastern Telegraph & Telephone Company, the independent company in Camden. It is said the Keystone will in a few months institute several improvements. The Eastern Telephone Company has about 2,500 subscribers.

SOMERSET, PA.—The Quemahoning Electric Power Company has been organized by Jonathan E. Giffen, of Stoyestown; C. W. Weigle, of Hooversville; J. L. Barcnus, of Salisbury, and D. S. Martin, of Pittsburg. It is the purpose of the promoters to install a large electric power plant in the vicinity of Hooversville, and, by a system of high-potential transmission, to furnish electrical energy for lighting, heating and power purposes to the towns of Hooversville, Stoyestown, Sprucetown, Jenners, Holsopple, Davidsville, Foustwell and the new mining town of Jerome.

TERRE HILL, PA.—The citizens are considering the question of lighting the town by electricity, and a committee has been appointed. Mr. Eli W. Martin, the promoter of the project, wants to install the plant in his mill. He asks the town to build the line from his mill to the town and will give 5 per cent on the money invested, and if the town is incorporated, will purchase the line. A committee consisting of Jacob Davidson, S. F. Foltz and J. C. Lessley was appointed to solicit the town and try and secure the money to build the line. This committee was also instructed to see the property holders about having this town incorporated into a borough.

WESTERLY, R. I.—A charter has been granted to the Westerly Power Company, with a capital of $700,000 to sell electricity and gas.

OLNEYVILLE, R. I.—Plans have been prepared for the Olneyville Telephone exchange, which is to be located on Bough Street, and a contract will be awarded in a few days.

WESTERLY, R. I.—One of the 250-hp Diesel oil engines that are to be used to generate electricity for the Westerly Power Company, has arrived. This engine is one of eight that the new company contemplates installing, five of which have been ordered. The contract for the erection of the new power house has been let to R. A. Sherman's Sons' Company. The power house is to be 80x40 feet, of brick, and the specifications call for its completion in 40 days. The company will also practically rewire the town for electric light and power.

MATTHEWS, S. C.—Bids will be received until June 1 by Leonidas Cain, Secretary Board of Public Works, at the office of the Town Council, for $20,000 water works and electric light bonds.

CLINTON, S. C.—Bids will be received until May 29 for the installation of a system of water works and an electric light plant. J. A. Bailey is chairman water works committee; Chas. C. Wilson, engineer, 1302 Main Street Columbia, S. C.

FT. MEADE, S. D.—Bids will be received until June 1 by Major George K. Hunter, Constructing Quartermaster at Fort Meade, for furnishing and installing electric light fixtures in six sets of officers' quarters, two sets of noncommissioned officers' quarters and one double barrack; also constructing secondary and service lines, furnishing transformers and wattmeters.

ABBEVILLE, S. C.—The Abbeville Light & Power Company has signed a contract with the Savannah River Power Company, which is making an important development 20 miles away, to supply it with 150 horse-power at 40 cents per hp-hour. The Savannah River Power Company expects to furnish unlimited power to Abbeville and Greenville, S. C., also to Elberton, Ga.

CHATTANOOGA, TENN.—It is reported that the Great Falls Power Company will develop the water power of the great falls on the Caney Fork River and that an electric railway is to be built from Nashville to Chattanooga. C. H. Fisk, of Detroit, Mich., one of the promoters of the scheme, has had a corps of engineers surveying a line through the mountains in the vicinity of Oates' Island.

LAREDO, TEX.—The Southeast Telephone Company contemplates overhauling and rebuilding its system in this city.

WACO, TEX.—The County Commissioners have decided to put an electric lighting plant in the court house, jail and other buildings belonging to the county. The contract has been let, and the plant will be installed as soon as possible.

WACO, TEX.—W. V. N. Powelson, a director and general manager of the Union Electric Light & Power Company, and a director in the

Laclede Gaslight Company and United Railways Company, of St. Louis, Mo., has purchased the Mutual Electric Company's franchise and lighting property in Waco, Tex., and will install a large electric light, power and gas plant there. Mr. Powelson and associates are considering installing lighting, power and gas plants in other cities in Texas and Kansas.

OGDEN, UTAH.—The Shoshone Power Company has petitioned the county commissioners for a franchise. It proposes furnishing Ogden, Salt Lake City and other cities in Utah, with power for heating and lighting purposes.

FRONT ROYAL, VA.—The old municipal electric light plant, which had been abandoned by the village, was destroyed by fire May 2.

FREDERICKSBURG, VA.—A new telephone company has been organized and will run a line from Louisa Courthouse through Spotsylvania, Hanover and Goochland Counties. The company will be a competitor of the Bell Telephone Company, which recently purchased the Louisa Company.

LYNCHBURG, VA.—The council committee on electric light will make a report recommending the establishment of a municipal electric light plant in the pumping station of the water works at the May session of the City Council. The pumping station will be available for this purpose after the installation of the gravity water system, which will be ready for use next fall. The plant, it is estimated, will cost $50,000.

SEATTLE, WASH.—The Seattle Electric Company contemplates extending its system to West Seattle.

NORTH YAKIMA, WASH.—This city is preparing to construct water works and an electric light plant.

SEATTLE, WASH.—The Seattle-Tacoma Power Company has made application to the City Council for a franchise to lay and operate pipes and conduits on certain streets of the city which are north of its present district of franchise rights. The application has been referred to the corporations committee.

ANACOTES, WASH.—The Mayor has signed the franchise ordinance granting E. G. English, Lester W. David, Albert Tozer, W. V. Wells, W. F. Robinson, R. C. Welts and D. H. Moss the privilege of building and operating an electric street railway in this city for a period of 39 years. The petitioners have not yet filed their acceptance of the franchise.

WHEELING, W. VA.—The Wheeling Traction Company has commenced work on the improvements on the road at Kentucky Heights, Benwood and South to Jim's Run. The company also contemplates the extension of the City Railway to Benwood in the near future.

KAUKAUNA, WIS.—The Council is considering the question of establishing a municipal electric light plant.

MILWAUKEE, WIS.—The Mayor has selected Irving B. Cary as one of the five commissioners who will oversee the erection of a municipal electric light plant. The term of appointment is five years. Mr. Cary was formerly employed at the Milwaukee electric plant.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has recently purchased three 22-kw exciters for direct-mounting on the shafts of the three 1,500-kw turbine generator units ordered some time ago from the Allis-Chalmers Company, of Milwaukee.

MILWAUKEE, WIS.—The Mayor has appointed five lighting commissioners for the purpose of taking charge of the construction of the new municipal electric lighting plant. The members of the commission are Irving B. Cary, Robert Hill, Michael J. Kruszka, Fred A. Landeck and Casper H. Kroeger. The term of appointment is five years. Mr. Cary was formerly employed at the Milwaukee electric plant.

BELOIT, WIS.—The Beloit Traction Company, which has been organized by business men of Chicago and Beloit, and will apply for a franchise at once. The company proposes to build six miles of track, and operate the system in conjunction with the Rockford, Beloit & Janesville Interurban Railway. The officers are J. B. Dow, president; C. A. Gault, vice-president; O. S. Baylies, secretary and treasurer. The company has a capital stock of $50,000, all of which has been subscribed.

NANAIMO, B. C.—The Hamilton Power Company has decided to spend $250,000 this summer in improving its plant here.

VANCOUVER, B. C.—The contract for supplying a series of alternating-current arc lamps for this city, has been awarded to the Canadian General Electric Company, for $20,400.

VANCOUVER, B. C.—The British Columbia Telephone Company will spend about $55,000 in installing switch boards, etc., in its new exchange now being erected. Address Superintendent Kent.

GREENWOOD, B. C.—W. S. Smith, of Greenwood, states that an electric plant is being installed on the Prince Henry, a high-grade silver property, located between Greenwood and Phoenix, B. C.

NEW WESTMINSTER, B. C.—The Burrard Power Company has received a grant from C. C. Fisher, Government water inspector, Vancouver, of 25,000 miner's inches of water and will develop 20,000 hp from Lillooet Lake and River at a cost of $1,000,000. Messrs. Herman and Burwell, of Vancouver, are interested.

CARNDUFF, CAN.—A local syndicate is being formed for the purpose of installing a telephone system. W. T. Lockhart is interested.

INDIAN HEAD, CAN.—The new municipal electric lighting plant has been completed and is in operation. The plant complete, cost about $28,000.

WINNIPEG, MAN.—The Kensington Land & Development Company, of Winnipeg, has offered to build an electric railway ten miles in length in Brandon, Man., at an estimated cost of $200,000.

WINNIPEG, MAN.—The Ogilvie Flour Mills Company is installing electrical machinery in its mills at Fort William and Winnipeg. This apparatus, which is to displace steam power, will be operated at 2,000 volts.

FT. FRANCES, ONT.—The Town Council has decided to install a complete system of water works, sewerage and electric lamps at a probable cost of $57,000. John Galt, of Toronto, is engineer.

KENORA, ONT.—Kelly Bros. & Company, of this town, have secured the contract for developing an extensive power plant at the inlet of the Lake of the Woods. Work will be commenced at once.

KENORA, ONT.—The town has decided to construct a power plant and develop from 5,000 to 7,000 horse-power at a cost of $150,000. T. Pringle & Sons, of Montreal, Que., are consulting engineers.

DRUMMONDVILLE, QUE.—The Standard Construction Company, of Montreal, Que., has secured the contract for installing the municipal electric lighting and power plant in this town.

Company Elections.

RIDGEFIELD, CONN.—At a recent meeting of the stockholders of the Ridgefield Electric Company the following officers were elected: President, Henry B. Anderson; vice-president, George P. Ingersoll; treasurer, A. H. Wiggins; secretary, Harvey P. Bissell; assistant secretary and superintendent, George Kirk, Jr.; directors, G. G. Haven, Jr., John A. Mitchell, Russell W. Lowe, M.D. Work on the plant of the company is progressing rapidly.

NEW ORLEANS, LA.—At a recent meeting of the directors of the New Orleans Railway & Light Company the following officers were elected for the ensuing year: President, E. C. Foster; first vice-president, R. M. Walmsley; second vice-president, Joseph H. DeGrange; third vice-president, A. S. Gibbs, of New York; secretary, Joseph H. DeGrange; assistant secretary, C. Marcel, of New York; treasurer, H. A. Ferranden; assistant treasurer, H. J. Jumonville; general counsel, Messrs. Denegre and Blair.

New Incorporations.

DOVER, DEL.—A charter has been issued to the Wilmington & Edge Moor Railway Company, with a capital stock of $200,000. The incorporators are Davis Ott and others.

WILMINGTON, DEL.—The Philadelphia Light & Equipment Company has filed certificate of incorporation with a capital stock of $300,000. The company proposes to furnish light, heat and power and equipments for the same.

STAR, IDAHO.—The Local Telephone Company, of Star, has filed articles of incorporation with a capital stock of $20,000 for the purpose of constructing and operating 19 miles of telephone lines throughout the rural districts surrounding Star. The incorporators are William A. Lawence and others.

GALESBURG, ILL.—The Home Light & Power Company has been incorporated with a capital stock of $10,000 by W. S. Cameron and others.

PEORIA, ILL.—The Peoria Railway Company has been incorporated with a capital stock of $1,000,000. The incorporators are W. H. Tazewell and others.

EAST ST. LOUIS, ILL.—The Dupue Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Lewis Beauman and others.

PEORIA, ILL.—The Salem, Peoria & Springfield Railroad has been incorporated with a capital stock of $100,000. The incorporators are Jonathan P. Reeves and others.

TAMAROA, ILL.—The Tamaroa Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are: C. O. Winthrop, C. R. Rice, J. T. Marlow.

MURPHYSBORO, ILL.—The Murphysboro Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are A. B. Minton, Thomas M. Logan and W. C. Alexander.

BELLEVILLE, ILL.—The West Dozen Telephone Company has filed articles of incorporation, with a capital stock of $1,900. The incorporators are R. J. Wilson, W. H. Miles and John Fauth.

MILLSTADT, ILL.—The St. Clair Farmers' Mutual Telephone Company has filed articles of incorporation with a capital stock of $2,000. The incorporators are Daniel A. Haas and others.

NEW ATHENS, ILL.—Dutch Hill Telephone Company has been incorporated with a capital stock of $480, to operate a telephone line. The incorporators are John H. Feurer, Peter Knewitz and Henry Wildy.

CHAMPAIGN, ILL.—The Springfield & Northeastern Traction Company has been incorporated with a capital stock of $1,000,000. The incorporators are Chas. Zilly and others. The company will construct a line from Springfield to Bloomington.

CHAMPAIGN, ILL.—The St. Louis, Champaign, Decatur Railway Company has been incorporated with a capital stock of $100,000 to build and operate an electric railway from Litchfield to Champaign. The incorporators are Charles Zilly and others.

CHICAGO, ILL.—The Chicago & Milwaukee Power Company has been incorporated with a capital stock of $100,000. A. C. Frost, F. S. Monroe and others are interested. This company was organized by the officers of the Chicago & Milwaukee Electric Railway to build a power plant to furnish power for the railway and to sell electricity.

OAKLAND CITY, IND.—The Oakland City Telephone Company has been incorporated, capitalized at $10,000. The company is in the market for material, equipment and bids for the construction of a modern telephone plant in Oakland and Gibson County. J. M. Vanderveer, J. W. McGowan, Alvin Wilson and R. S. Mason are the incorporators.

FT. GIBSON, IND. TER.—The Fort Gibson Development Company has been incorporated, with a capital of $200,000 by L. J. Marlin, W. P. Moore and B. F. Rice. The company proposes to furnish heat, light and power and to build electric plants and railways in Ft. Gibson.

OTTUMWA, IA.—The Ottumwa & Southeastern Iowa Interurban Railway Company has been incorporated with a capital stock of $750,000, to succeed to the property of the Ottumwa Light & Traction Company. The incorporators are Charles E. Coffin, Lew V. Uhey, Charles A. Walsh, Herman J. Ostdeik and Harry Miesse.

DURHAM, IA.—The Plymouth Farmers' Mutual Telephone Company has been incorporated under the laws of Iowa.

LOOMSBURG, PA.—The Roaringcreek Valley Telephone Company will apply for a charter to start with a capitalization of $5,000.

ROYALTON, MINN.—The Pike Rapids Power Company has been incorporated, with a capital stock of $100,000.

EAST ORANGE, N. J.—The Providence Light & Equipment Company has been incorporated with a capital stock of $100,000 for the purpose of operating lighting plants. The incorporators are Edward E. Buren, Harry E. Crandall and James McIntosh.

JERSEY CITY, N. J.—The Fort Dodge Light Company has been incorporated with a capital stock of $350,000. The incorporators are Howard A. Thornton, H. O. Coughlin and John R. Turner. The company is to act as a holding company and deal in all kinds of securities.

BUTLER, N. Y.—The Butler Independent Rural Telephone Company has been incorporated with a capital stock of $1,000 by J. B. Atkins and others.

OSWEGO, N. Y.—The Southwest Oswego Telephone Company has been incorporated with a capital stock of $600. The incorporators are F. McBride and others.

CLARKSVILLE, N. Y.—The Lake Valley Telephone Company has been incorporated with a capital stock of $300. The directors are William H. Van Nalton and others.

NEW YORK, N. Y.—The Consolidated Water Powers Corporation has been incorporated with a capital stock of $500,000 to manufacture electricity. The directors are H. I. Brightman, New York; W. S. McClelland, Eustice, Fla.; F. J. Collier, Hudson, N. Y.

LITTLE FALLS, N. Y.—The Little Falls & Canada Lakes Railroad Company has been incorporated with a capital stock of $200,000 to operate an electric railway from Little Falls to Canada Lakes, a distance of 20 miles. The directors are R. S. Storrs, E. E. Witherby, S. R. Bertron, New York; H. P. Collins and M. G. Bronner, Little Falls.

ADAMSVILLE, OHIO.—The Adamsville Telephone Company, of Muskingum County, has increased its capital stock from $3,000 to $10,000.

CUMBERLAND, OHIO.—The German Telephone Company has been incorporated with a capital stock of $500. The incorporators are Christian Wielke and others.

WASHBURN, N. D.—The Washburn Water & Light Company has been incorporated with a capital of $25,000 by Karl Klein, W. A. Persey, Aug. E. Johnson and others, all of Washburn.

BARBERTON, OHIO.—The Barberton Telephone Company has filed articles of incorporation with a capital stock of $30,000. The incorporators are A. R. Henry, James McNamara and others.

STILLWATER, OHIO.—The Stillwater Mutual Telephone Company has been formed by A. J. Murphy, A. J. Groves, J. C. Groves, H. W. Howell and A. E. Collins. The capital stock is $10,000.

GALION, OHIO.—The Galion, Mt. Gilead & Delaware Traction Company has been incorporated with a capital stock of $10,000 by C. A. White, Harry S. Griffith, John McNeal, Newton Ruhl, W. P. Vaughan, W. M. Carlilse and C. L. Russel.

ALINE, OKLA.—The Aline Telephone Company has been chartered with a capital stock of $5,000. John Hartshorne and others are interested.

MOUNTAIN PARK, OKLA.—The Mountain Park Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are W. W. Watson and others.

SHATTUCK, OKLA.—The Shattuck Electric Light & Power Company has been incorporated with a capital of $3,000 by W. G. Shears, R. A. Moody and others, all of Shattuck.

PITTSBURG, PA.—The East Deer Light & Power Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are George S. Davidson and others.

PITTSBURG, PA.—The O'Hara Light & Power Company has been incorporated with a capital stock of $5,000. The directors are George S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

PITTSBURG, PA.—The Springdale Light & Power Company has been incorporated with a capital stock of $5,000. The directors are Geo. S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

BRACKENRIDGE, PA.—The Brackenridge Light & Power Company has been incorporated with a capital stock of $5,000. The directors are Geo. S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

TARENTUM, PA.—Articles of incorporation have been filed by the Tarentum Electric Light & Power Company, with a capital stock of $5,000. The directors are Geo. S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

PITTSBURG, PA.—The Harrison Light & Power Company has filed articles of incorporation with a capital stock of $5,000. The directors are Geo. S. Davidson, Edgewood; John H. Milliken, Allegheny, and C. T. Marsh, Swissvale.

WEATHERFORD, TEX.—The Home Telephone Company, of Weatherford, has been incorporated with a capital stock of $50,000. The incorporators are J. A. Murray and others.

New Industrial Companies.

THE ALPHADUCT COMPANY, of Toronto, Ont., has been incorporated with a capital of $40,000 to manufacture electrical supplies. The directors are F. B. Johnson, C. W. Bongard, A. J. Thomson, all of Toronto.

THE G. E. WATTS ELECTRICAL CONSTRUCTION COMPANY, of Baltimore, has been incorporated with a capital stock of $1,000, by Samuel M. Sachs, J. J. McNulty, D. Gray Elderkin, W. N. Hechheimer and Harry Hechheimer.

THE AJAX LINE MATERIAL COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $12,000. The company will manufacture electric specialties. The incorporators are Charles J. O'Connor, Ralph P. Polley and N. O'Connor.

THE BRIGHTLIGHT INVERTED GAS & ARC LAMP COMPANY, of New York, N. Y., has been incorporated with a capital stock of $200,000, for the purpose of manufacturing gas and arc lamps, mantles, etc. Gustav Reif, 202 West 114th Street; Martin W. Bethke, 208 East 21st Street, and others, are the incorporators.

THE ARC SPARK PLUG MANUFACTURING COMPANY, of Toledo, has been formed with E. A. Spark, president; H. J. Brubach, vice-president; P. S. Fancher, secretary and treasurer. The company will manufacture a new ignition device for gasolene engines. The device is now being manufactured in a Toledo factory, but the company is planning to erect its own plant.

Legal.

SAFETY ARMORITE CONDUIT COMPANY, of Pittsburg, Pa., has brought suit in the U. S. Circuit Court of the Southern District of Ohio against the Mark Manufacturing Company, of Chicago, Ill., and Zanesville, O., for infringement of its patent for a cleaning and enameling pipe for use in electric iron armored conduit.

NON-CONDUCTIVE TOOLS.—Alexander Smith, while cleaning snow from the Manhattan Elevated Road in December, 1902, formed a short circuit with his shovel between the third rail and an iron bolt which projected from the track. He alleged that his right eye was injured by the accident. Smith brought suit against the Manhattan Railway Company on the ground that it was the duty of the company to provide him with a wooden shovel or some other non-conductive tool for use near the third rail. Judge McCarthy, of the City Court tried the case, and a jury returned a verdict in favor of the plaintiff for $1,900. The Appellate Term of the Supreme Court set aside the verdict, holding that the plaintiff, having worked on the structure for six months, was well aware of the danger of the third rail, and the accident was due to his carelessness. Justice McLaughlin and his associates of the Appellate Division sustained the judgment of the lower court, with costs. The opinion handed down by Justice McLaughlin says that there is no special danger in the third rail, but that the company should not furnish iron shovels for use near it.

Educational.

UNIVERSITY OF WISCONSIN.—The sixth annual session of the Summer School for Artisans held under the direction of the College of Engineering of the University of Wisconsin begins June 25th, and continues for a period of six weeks. Courses of study are offered in the following subjects: Engines and boilers, applied electricity, mechanical drawing and machine design, materials of construction, fuel and lubricants, shop work, and manual training. The instructional force is taken from the regular faculty of the College of Engineering, and the entire laboratory and shop equipment belonging to the college is used by the students in the summer school. The requirements for admission do not extend beyond a working knowledge of English and arithmetic, but the policy is to allow a large amount of individual work so that the student may take advantage of all the preparation he has obtained. This school offers to those unable to take a regular four years' course, an opportunity of obtaining a working knowledge of the methods of testing and the use of instruments, together with such theoretical principles in each case as the nature of the subject and the preparation of the student may permit. Correspondence students have found this school of value in giving an

opportunity for laboratory practice along the lines in which they have had theoretical instruction. A bulletin describing the work of the School for Artisians in detail will be sent on application to Frederick E. Turneaure, Dean, College of Engineering, Madison, Wis.

Obituary.

MR. W. E. NEWHALL, for many years treasurer of the R. D. Wood Company, of Philadelphia, died on May 1 at the Pennsylvania Hospital, Philadelphia, as the result of an accident in falling through an open areaway in the sidewalk, that apparently had been left unguarded. He was 71 years of age, and his eyesight was defective. He was one of the oldest members of the Union League Club.

Personal.

MR. FRANK N. WATERMAN, mechanical and electrical engineer, has removed his offices from 100 Broadway to 150 Nassau Street, New York.

MR. J. W. DUNTLEY, President Chicago Pneumatic Tool Co., sailed for Europe on May 3 in the interest of the company's business.

MR. C. L. LATHROP has been appointed superintendent of telegraphs and signals of the Pittsburg, Shawmut and Northern Railroad Company.

MR. CECIL T. WILKINSON sailed for Europe on May 8, and will remain abroad for several months, during which he will visit the principal points of electrical interest on the Continent and in Great Britain.

MR. W. H. SCHOTT, engineer, designer and builder of central station heating plants, electric railway and light plants, has moved his offices from the Marquette Building, Chicago, to the newly erected American Trust and Savings Banks Building.

MR. HENRY D. JACKSON has removed his offices from 83 Newbury Street to 4 State Street, Boston, where he will continue to carry on business as consulting electrical engineer, making a specialty of electrolysis, power distribution and power plant economy.

MR. OREN ROOT, JR., who has been active in the Metropolitan Street Railway Company for 11 years, entering its service upon graduation at the age of 22, has been elected vice-president of the company. He has been general manager for about three years.

MR. R. D. TOMLINSON, president of the National Association of Stationary Engineers, delivered a paper at a meeting last week on "Power Station Design, Construction and Operation" before the Cincinnati branch of the National Association of Stationary Engineers.

MR. G. E. WATTS, formerly of the Watts & Uthoff Supply Company, of St. Louis, is now connected with the G. E. Watts Company at Atlanta, Ga. The company has made a thorough survey of the needs of the Southern field and is prepared to carry on an extensive business in electric railway and lighting supplies—especially the former.

MR. M. M. REID, of Columbus, O., has been appointed superintendent of the municipal electric light plant in that city. Mr. Reid was formerly master mechanic and chief engineer of the Appleyard system of traction lines centering at Columbus and before that he was with the Southern Railroad Company of New Jersey. He succeeds William Wilcox.

MR. NORMAN MARSHALL, president of the Marshall Electric Manufacturing Company, Boston, a graduate of the Worcester Polytechnic Institute of the class of 1886, has offered to give to the institute all electrical supplies manufactured by his company that may be required in the electrical equipment of the new electrical engineering building.

MR. EUGENE N. FOSS, of the B. F. Sturtevant Company, and leader in the cause of reciprocity and tariff revision, is in Europe, having sailed in March. He has gone abroad partly for rest, but particularly to meet some of the leading statesmen and merchants of England and the Continent, in connection with his studies of certain economic questions in their relation to the foreign trade of the United States.

MR. JULIUS S. JENSEN, of New Haven, Conn., has been appointed superintendent of the power stations and give charge of construction of the Consolidated Railway Company. The office includes all the lines of the company in Connecticut, Massachusetts and Rhode Island, Mr. Jensen has been a mechanical engineer in the electrical department of the railroad for the past few years, before which he was in the motive power department. He is a native of Copenhagen, and graduated from a technical school in that city.

MR. GRAHAM SMITH, formerly in charge of Westinghouse exposition and convention publicity, as the New York Westinghouse press representative, and recently engaged in advertising work under his own name, will sail next week for a journalistic tour of several months abroad. On his return he will assume the direction of the Eastern advertising interests of several corporations of the Middle West and West, with an office in the Flatiron Building, New York, and will make a specialty of the preparation of industrial books of the higher class. Mr. Smith was born in Buffalo on August 24, 1878, and was graduated from Harvard College, with high honors in English, in 1900. After a year's travel, he spent three years on the staff of the New York *Evening Sun*, as news reporter, assistant city editor, real estate editor, and writer on financial topics. The latest example of his literary work is the handsome souvenir book descriptive of the Westinghouse exhibits at last year's International Railway Congress at Washington.

Trade Publications.

BOILER FEED PUMPS.—Circular No. 54 of the Dean Bros. Steam Pump Works, Indianapolis, Ind., is devoted to boiler feeders or pressure pumps. These pumps are built with either simple or compound steam ends, and either in single units or in pairs.

SMALL POWER MOTORS.—A line of small power motors of both the direct-curent and alternating-current types is described in circular No. 1,128 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. These motors are rated at from .05 hp to .125 hp.

INCANDESCENT LAMPS.—One of the most interesting pieces of trade literature recently received is from the Boston Incandescent Lamp Company, Danvers, Mass., and is entitled "A Lamp Factory Fable." It makes interesting reading for the central station manager and the lamp buyer in general.

ELECTRICAL SUPPLIES.—In order to contribute to the convenience of its customers and to insure that its orders will be received in uniform style, the Central Electric Company, 207 Jackson Boulevard, Chicago, Ill., has been distributing an order book in which a duplicate is prepared simultaneously with the original.

TESTING LABORATORIES.—The paper by Dr. C. H. Sharp on "A Testing Laboratory in Practical Operation," which was presented at the November, 1905, meeting of the American Institute of Electrical Engineers, has been reprinted with numerous illustrations by the Electrical Testing Laboratories, New York.

THE BAY STATE LAMP COMPANY, of Danvers, Mass., is sending out a very interesting little booklet "How Bay State Lamps Are Renewed." This is very interesting literature for the lamp buyer, explaining clearly the process of renewing, and the tests used, and it appears to lay before the public facts which heretofore have not been given much publicity.

DIRECT-CURRENT MOTORS AND GENERATORS.—Bulletin No. 367 of the National Electric Company, Milwaukee, Wis., gives a description of the constructional features and operating characteristics of a complete line of direct-current generators and motors. These machines vary in size from 1 to 50 hp, and are designed for 110, 220 or 500 volts.

CIRCUIT BREAKERS.—The General Electric Company, Schenectady, N. Y., uses bulletin No. 4436 to present the constructional features and operating characteristics of direct and alternating current, automatic, carbon break circuit breakers. Descriptions are given of circuit-closing and circuit-opening auxiliary switches and of overload, overload low-voltage and shunt trip attachments.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has issued a circular in pleasant form, on "Spring Painting." It calls attention to its graphite and silica-graphite paints and shows how these can be utilized on all classes of work. It also issues an illustrated folder, "Colors and Specifications," containing practical suggestions for construction and maintenance painting.

ROCK CRUSHING PLANTS.—Catalogue No. 4 of the Power and Mining Machinery Company, Cudahy, Wis., is a 72-page publication dealing with machinery for rock crushing plants. A large portion of the catalogue is devoted to a detailed description of the McCally gyratory crushers, while numerous drawings are given of complete plants in which these crushers and auxiliary apparatus are used.

ATTACHMENT PLUGS.—A neat little folder isssued by the H. T. Paiste Company, Philadelphia, Pa., which contains a few comments intended to bear the truth to the electric lighting man who wants the best, gives a brief list of brass-cap and porcelain styles of attachment plugs. These plugs have been designed for use where neatness is taken into consideration. The company has also issued price list No. 6, dealing with its complete line of electric lighting specialties.

STORAGE BATTERIES.—An interesting booklet containing complete instructions for the care of "Exide" batteries in electric vehicles has recently been issued by the Electric Storage Battery Company, Philadelphia, Pa. While a portion of the descriptive matter relates specifically to batteries for vehicles, the major portion is applicable to storage batteries in general, and the information contained in the booklet should prove of value to any one dealing with the operation of storage batteries.

ELECTRIC HOISTS.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, has issued a well-prepared catalogue dealing with standard and special electric hoists. These hoists are arranged to be driven by means of either direct or alternating-current motors. Among the special electric hoists, may be mentioned one driven by a 150-hp and a 75-hp induction motor, and another driven by a 300-hp induction motor for hoisting 6,000 pounds at a speed of 1,000 feet per minute, and another hoist provided with an 800-hp alternating-current motor which delivers 17 tons of matter per minute at a height of 555 feet.

CARBON-BREAK CIRCUIT BREAKERS.—Bulletin No. 603 of the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., describes three types of circuit breakers, designated as type C-16, C-7 and C-11 respectively. Type C-16 breakers are intended for use with direct-current at from 250 to 650 volts, with from 15 to 1,200 amperes. Type C-7 may be used with either direct or alternating current at from 250 to 550 volts, and it will carry from 3 to 300 amperes. Type C-11 has been designed especially for heavy service. It is made in two styles, one for 250 volts and the other for 650 volts, and for all values of current from 2,000 to 6,000 amperes.

FAN MOTORS.—In an artistically executed catalogue designated as No. 1051, the General Electric Company, Schenectady, N. Y., gives out-

line descriptions of fan motors of both the alternating and the direct-current type and of small power motors for various purposes. The rotor of the alternating-current motor is of the squirrel-cage form while the stator is provided with projecting poles each of which is equipped with a "shading" coil for producing a revolving field. The direct-curent motor is built with axially sloping armature slots in order to render it noiseless in operation. The small power motors are designed for use with portable drills, bench drills, blowers, sewing machines, etc.

CENTRAL STATION ADVERTISING.—The Denver Gas and Electric Company has issued a booklet to which has been given the title "Boosts." The contents are made up of newspaper clippings in which Denver is referred to as the "City of Lights," a term which has been acquired through the energetic efforts of the Gas and Electric Company. The clippings have been taken from papers published in Philadelphia, Boston, Cleveland, St. Paul, Omaha, Detroit, Lincoln, Buffalo, St. Joseph, Milwaukee, Chicago and Binghamton, so that they come from disinterested observers and have not originated from self praise, although municipal pride has been to a large extent responsible for the existence of the conditions which justify the use of the term.

MOTOR CONTROLLERS.—An attractive bit of advertising matter entitled "Various Applications of Ward Leonard Rheostats, Circuit Breakers and Resistance Units," has recently been issued by the Ward Leonard Electric Company, Bronxville, N. Y. Illustrations are given of machine tool drives complete with controlling apparatus. With almost no exception the descriptive matter is so arranged that the service to which the electrical equipment is put can be learned readily, and much valuable information can thus be obtained as to the proper combinations for various installations. The rheostats are of the "fool-proof" type. It is stated that a poor motor will have a long life if protected by a good rheostat, but a poor rheostat will ruin even a good motor in a very short time.

HOTEL PIPE COVERING CONTRACTS.—The H. W. Johns-Manville Company, through its Philadelphia Branch, completed recently two of the season's largest contracts for the installation of its various pipe coverings, in the plants of the hotels The Marlborough-Blenheim and The Denis, Atlantic City, N. J. In the plant of the former all of the hot, salt and fresh water pipes are covered with its "J-M" moulded, and all steam pipes with its well-known "J-M" 85 per cent magnesia covering. In The Denis the entire heating system is covered with "J-M" three-ply asbestos air-cell covering, and high pressure work with 85 per cent magnesia. In the placing of these contracts none but manufacturers of the highest reputation were considered, and the H. W. Johns-Manville Company is to be complimented on securing these orders. The coverings referred to above are only a few of the many standard coverings manufactured by this company, which has recently gotten out a very neat and attractive booklet entitled "Pipe and Boiler Insulation," in which these materials are fully illustrated and described. A copy will be sent to interested parties for the asking.

News of the Trade.

THE OHIO BRASS COMPANY has moved its New York office from 136 Liberty Street to 43-49 Exchange Place, New York City.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, announces the opening of a branch office in Pittsburg. This office will be located in the Frick Building Annex.

HOLTZER-CABOT ELECTRIC COMPANY, of Boston, has severed its connection with W. Green & Co., 6 Maiden Lane, New York City, and will hereafter sell its motors to the jewelry trade direct.

THE KINSMAN ELECTRIC & RAILWAY SUPPLY COMPANY, of New York, has moved its business from 93 Liberty Street to 55 Dey Street, where more extensive and commodious quarters have been secured.

THE B. F. STURTEVANT COMPANY, of Boston, Mass., has, among recent orders, furnished mechanical draft apparatus for 1,200 hp to the Lackawanna Lighting Co., Scranton, Pa., and 2,700 hp to the Edison Electric Illuminating Co., Williamsport, Pa.

ELECTRIC STORAGE BATTERY COMPANY.—The sales office of this company, located formerly in San Francisco, has been transferred to 525 Thirteenth Street, Oakland, Cal. All business connected with the Pacific Coast territory will be handled from that office.

THE LORD ELECTRIC COMPANY has recently moved its New York offices to the ninth floor of the Fuller building, where it has more commodious quarters for its rapidly increasing business. The company now has contracts for the electric construction work in many of the large buildings under construction in New York City, and there is an increasing demand for the electric railway specialties which it manufactures.

SPECIAL 100-TON FLAT CARS FOR MACHINERY.—The Allis-Chalmers Company, Milwaukee, Wis., has placed with the C., M. & St. P. Railway an order for two 16-wheel flat cars capable of carrying 200,000 lbs. each, which are the first of their kind in existence. These cars were required for conveying a frame and side of a monster horizontal rolling mill engine built by the Allis-Chalmers Company for the Carnegie Steel Company's plant at Sharon, Pa.

ELECTRIC SIGNS.—A real estate company, which is developing a suburban town north of Dayton, O., has erected a mammoth electric sign calling attention to "Ft. McKinley," as the town is called. It is on high ground and can be seen for several miles. It is claimed to be the largest electric sign west of New York City, the letters being eight to ten feet high. So far as is known this is the first electric sign ever placed on a piece of suburban real estate in this country. The sign was built by the R. R. Sign Company of Dayton.

THE ELECTRIC CABLE COMPANY has moved its New York office from 42 Broadway to more commodious quarters at 17 Battery Place. The company has just received large orders for Voltax, the new insulating compound from the American Railways Company, of Philadelphia; S. Pearson & Son, contractors on the Pennsylvania Tunnel, and from the United Water Improvement Company, of Philadelphia. Reports show that this material has been used successfully both as an insulating compound and as a waterproofing. The company reports the sale of this compound in large quantities to 50 leading railways in this country and in England, France, Germany and Italy.

VULCAN ELECTRIC HEATING COMPANY.—The business of L. P. Brown & Co. has been incorporated under the laws of the State of Illinois, to be known hereafter as the Vulcan Electric Heating Company. The offices remain at 71 West Jackson Boulevard. Additional capital will be used in the business and the plant and facilities will be enlarged to meet the rapidly increasing demands of its customers. The Vulcan Electric Heating Company assumés all obligations and has acquired all accounts, stock, equipment, patent and trademark rights and manufacturing processes of the old firm. It will take up various lines of practical designing and engineering in connection with its electric heating specialties.

THE SHELBY ELECTRIC COMPANY, of Shelby, Ohio, received a novel message from C. D. Pierce, its representative in San Francisco, a few days after the big fire. The message was written on half of one of Mr. Pierce's collars. On one side he had written the address of the Shelby Electric Company, while the other contained the words, "Both safe. Stock and office gone. Pierce." The use of half of his collar showed the dire extremity to which Mr. Pierce had been put for writing materials in the confusion which followed the fire. There was no stamp upon the unique souvenir card as the post office issued an order immediately after the fire, making postage from San Francisco collectable from the receiver. The Shelby Company's loss was about $5,000.

THE CENTRAL ELECTRIC COMPANY, Chicago, is now well established in its new quarters at 264-270 Fifth Avenue. This is in the same location as the building previously occupied by it, which was totally destroyed by fire. It now has the best appointed electrical supply house in the down-town district of Chicago. It occupies four floors of a building with 100 feet frontage, giving it an aggregate of about 60,000 sq. ft. floor space. The city sales department, which is splendidly arranged and organized, occupies the first floor. The general offices occupy the second floor, where also are the miscellaneous supplies in broken and unbroken packages. The third floor and basement are given to wire and heavy material. The offices and city sales department are handsomely finished in oak and the appointments are all of the best.

THE ARNOLD COMPANY on May 1 moved from the quarters in the Marquette Building which it has occupied for many years to the sixteenth and seventeenth floors of the Borland Building, corner La Salle and Monroe Streets, Chicago. Although the company's old offices had been frequently extended from time to time, they were entirely outgrown. In the new quarters the company occupies an entire floor for its offices and has its draughting room on the next floor above. A structural steel department has recently been added to handle the building problems which arise in connection with construction work. The company as engineer and constructor is building the Elgin & Belvidere Electric Railway, a 35-mile road; is making preliminary reports and estimates on several electric railway properties; has just finished the construction of shops for the C., H. & D. Railway at Ivorydale, Ohio; and is designing several other steam railroad shops; is drawing plans for two more hydro-electric plants for the Spring River Power Company near Joplin, Mo., besides much other work. The company's policy of handling certain parts of the work as engineer and then as actual constructor on a basis of cost plus a percentage has a broadening effect on its engineering work.

THE ENGINEERING AGENCY.—The controlling interest in the Engineering Agency, Inc., Chicago, which was organized in 1893 by Frederick A. Peckham, has been purchased by A. G. Frost. At the last director's meeting, Mr. Frost was elected president. Mr. R. D. Smith, vice-president, and Mr. P. W. Herring, secretary and treasurer, retain their offices as heretofore. The Agency has a branch office in Pittsburg and contemplates opening within the next thirty or sixty days offices in New York and Denver. The head of the mining department of one of the prominent western mining schools will probably take hold of the company's Western business. There has been an unprecedented growth in the securing of competent engineering assistants through this bureau by the better grade of employers; for instance, on an average of 250 men are placed monthly through the Chicago office, and the Pittsburg office has only been running about three months, and this month will place between 75 and 100 men. The salaries of these positions range from $75 to $500 per month and include all sorts of mechanical, electrical, civil, mining and architectural engineers and draftsmen, besides superintendents for contractors, managers of technical enterprises, etc. The demand at the present time for engineers and draftsmen is very great and good men are at a premium. It is no uncommon thing for employers to offer $10 to $25 per month more for a man than their present employer pays them for doing the same work. Through the J. G. White Company the Agency has sent a party of twenty men to the Philippines on the Government railroad work there. Men are constantly being sent to Mexico, South America and the Far West. The moderate commission charged by this bureau for its services is in a great measure the cause of its popularity.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 1, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N.Y.]

819,049. ELECTRIC BELL; John Erickson, Chicago, Ill. App. filed Oct. 31, 1904. Relates to a construction of telephone bell with the usual polarized armature vibrating adjacent to the poles of a magnet. The armature is pivoted on a U-shaped spring or extension from the permanent magnet pole so as to permit an adjustment in the position of the armature.

819,050. INDICATING DEVICE FOR AUTOMATIC TELEPHONE-SWITCHES; John Erickson, Chicago, Ill. App. filed Dec. 30, 1904. An individual switch for automatic telephone systems, said switch being provided with an operative part under the control of the subscriber, and adapted to be given a plurality of positions, one of said positions being appropriated solely for the purpose of transmitting alarms or special signals, and an indicating device responsive to said appropriated position, and adapted to remain operated until manually restored and without interfering with the natural restoration and further use of said switch.

819,059. MOUTHPIECE FOR TELEPHONE TRANSMITTERS; Harry J. Guttman, Chicago, Ill. App. filed Oct. 21, 1904. As an article of manufacture, a mouthpiece for telephone transmitters, said mouthpiece consisting of a hollow body portion of drawn steel, having a bend or deflection in the metal providing external and internal shoulders, and a separately-formed perforated diaphragm secured within the base of said hollow body portion and against said internal shoulder, the said hollow body portion being externally threaded between its external shoulder and its smaller end, said threaded portion being cylindric and internally smooth, and means integral with the said bend or deflection for holding the diaphragm in place against the internal shoulder.

819,060. TERMINAL STRIP; Harry J. Guttman, Chicago, Ill. App. filed Nov. 9, 1904. A strip of insulation provided with openings, and a plurality of metal strips extending crosswise of said strip of insulation, each metal strip having end portions lying flatwise upon one surface of said strip of insulation, and having also an intermediate portion lying flatwist against the opposite surface of said strip of insulation, the said metal strips being suitably spaced apart and insulated from each other and provided with free ends adapted for connection with circuit-conductors.

819,061. TELEPHONE SWITCH-HOOK; Harry J. Guttman, Chicago, Ill. App. filed Nov. 25, 1906. A telephone switch-hook constructed from a single integral sheet-metal blank bent and folded into shape to provide a neck or body of double thickness, a hook or supporting prongs of single thickness, and attaching means of single thickness.

819,071. ELECTRICAL MEASURING INSTRUMENT; Frederick A. LaRoche and Maurice C. Rypinski, New York, N. Y. App. filed Nov. 8, 1904. Relates to details in the manner of supporting the movable element so as to surround a fixed core. The invention is claimed as a "F-shaped center piece for electrical measuring instruments having two pairs of forwardly extended arms."

819,073. MEANS FOR CHARGING STORAGE BATTERIES OF TELEPHONE SYSTEMS; Talbot G. Martin, Chicago, Ill. App. filed Dec. 12, 1904. A telephone system comprising a manual exchange, an automatic exchange, a trunk line extending between the two exchanges, a storage battery at the manual exchange, a source of current at the automatic exchange for charging the said storage battery, together with a charging-circuit including one side of the said trunk-line.

819,082. ELECTRIC RELAY; Michael Setter, Chicago, Ill. App. filed Oct. 31, 1904. Telephone relay having a L-shaped armature stamped of sheet metal with trunnions integral therewith. One arm of the armature is extended into connection with a blade spring having platinum contacts which is thereby displaced.

819,083. ELECTRIC BELL; Michael Setter, Chicago, Ill. App. filed Oct. 31, 1904. Details of construction of a telephone call bell relating particularly to the adjustment of the armature. This is disposed on a slidable extension from the permanent magnet and has its position determined by a beveled set screw.

819,084. TELEPHONE-TRANSMITTER; Michael Setter, Chicago, Ill. App. filed Oct. 31, 1904. A telephone-transmitter comprising a casing, a diaphragm, a support secured to the diaphragm, a vibratory front electrode secured to the diaphragm, a stationary back electrode secured to the said support, granular carbon between said electrodes, and means for holding or inclosing the granular carbon, the said diaphragm, support, electrodes, carbon-holding means and granular carbon being inclosed within said casing, and the same being organized into a structure which is removable as a unit from the interior of said casing the means for holding or inclosing the granular carbon being vibratory with the diaphragm and removable with the electrodes through an opening in the back of said unit.

819,085. STRIP OF LAMP-JACKS; Michael Setter, Chicago, Ill. App. filed Jan. 13, 1905. A strip of lamp-jacks having a body made of sheet metal bent into shape to provide an integral front plate having a plurality of lamp-openings, and lamps in said jacks.

819,095. COMMUNICATING ELECTRIC SYSTEM; Alexander M. Stark, Toronto, Canada. App. filed Aug. 9, 1902. A telephone exchange system having various detail features in the electric circuits and relays. One feature mentioned as novel is the use of a dynamo with storage battery bridging across its terminals to steady the current therefrom.

819,146. TROLLEY-WHEEL GUARD; James H. Lane and Uriah Gulnick, Newark, N. J. App. filed May 3, 1905. A pair of L-shaped arms are swiveled on vertical axis to the harp so as to normally close over and retain the trolley conductor in place under the influence of tension springs connected to the arms for this purpose.

819,160. POLE CHANGER; Roger M. Newbold, Louisville, Ky. App. filed July 8, 1905. The rotating shaft of a reversible dynamo has a worm and gear connection with a friction band which moves the switch to its alternate position when the direction of rotation is reversed.

819,190. ELECTRIC SIGNALING SYSTEM; Jean F. Webb and Clayton E. Frederickson, Denver, Col. App. filed Apr. 25, 1905. An automatic telephone system having a toothed wheel for every subscriber which is stepped around in the manner of an ordinary messenger call to make any connection desired.

819,195. ELECTRIC ELEVATOR; Parvin Wright, Los Angeles, Cal. App. filed Jan. 19, 1905. Complete elevator installation and circuits, including the mechanical features of the circuit breakers, and braking mechanism. Also the stop motions for the top and bottom of the shaft.

819,206. COMBINED FUSE AND SWITCH; Frederick H. Cheyne, Indianapolis, Ind. App. filed Jan. 12, 1905. The switch element has recesses on its face for the attachment of the ordinary form of incandescent lamp circuit fuse plug. This furnishes the means of connection with the stationary spring blades constituting the other terminal of the switch.

819,209. APPARATUS FOR TREATING LIQUIDS; Leon Dion, New York, N. Y. App. filed June 3, 1904. The combination with a vessel or reservoir, and means through which a liquid may be supplied to it, of a group of co-operating positive and negative electrodes, with which the liquid contained within the vessel or reservoir may be brought in contact, constructed in prismoidal form angularly bent transversely of their axes, and means through which a current of electricity may be supplied to such electrodes, substantially as described.

819,218. SUPERHEATING COMPOUND; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the manufacture of calcium carbid, a superheating compound comprising calcium carbid, carbon, an oxygen-producing substance, and a metallic element, as and for the purpose set forth.

819,219. MANUFACTURE OF CARBID; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the manufacture of carbid, the method which consists in first fusing lime and carbon containing elements to reduce the same to liquid or fluid condition, and finally supplying carbonaceous material to the mass while in a molten condition, to complete the conversion of metallic elements or particles of the mass.

819,220. METHOD OF PRODUCING CARBID; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the manufacture of carbid, the method which consists in fusing lime and carbon containing elements to reduce the same to molten condition, and finally running off the molten mass into thin sheets to chill the same.

819,221. PROCESS IN THE PRODUCTION OF CARBID; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the production of carbid, the method which consists in applying to the interior surface of a suitable mold a material impervious to water, and then flowing the molten carbid in fluid state directly from the furnace into such mold, whereby the carbid is uniformly coated and impregnated superficially with the said material while fluid are in a state of incandescence, as and for the purpose set forth.

819,222. MANUFACTURE OF CARBID; Herman L. Hartenstein, Chicago, Ill. App. filed July 23, 1902. In the manufacture of carbid, the process which consists in calcining limestone in the presence of carbonaceous material, then adding to the calcined mass a mixture of calcium carbid, black oxid of manganese, bituminous coal, aluminium and chlorate of potash, to maintain the temperature of the heated mass and to expel or drive off any phosphorus present therein, and finally fusing to melting the mass.

819,224. ELECTRIC FURNACE; Herman L. Hartenstein, Chicago, Ill. App. filed July 26, 1902. In an electric furnace, a furnace-chamber, electrodes projecting into said chamber, means for adjusting the inclination of said electrodes, independent means for adjusting said electrodes laterally, and means for adjusting the extent of projection of said electrodes into said chamber, as and for the purpose set forth.

819,242. ALTERNATING CURRENT METER ON FERRARIS PRINCIPLE; Emanuel Morck, Frankfort-on-the-Main, Germany. App. filed May 10, 1904. Has an auxiliary coil containing iron, dependent on the main current and having approximately a quadratic curve of magnetization as long as the iron remains unsaturated by the current in question.

819,267. TELEPHONE-TRANSMITTER; William W. Dean, Chicago, Ill. App. filed Oct. 27, 1902. In a telephone-transmitter, the combination with a sound-receiving diaphragm, of a single flat shallow chamber containing comminuted conducting material and in which the said material may pass from one part to another, a positive, negative and an intermediate electrode in said chamber, and means to divide the current-path through the material in said chamber into several parts, the arrangement of said electrodes being such as to cause the current to traverse said parts in series, substantially as described.

819,268. ELECTRIC SPARKING DEVICE; Albert E. Doman, Elbridge, N. Y. App. filed Feb. 1, 1905. Instead of a short, thick core for the induction coil, as ordinarily used, the patentee makes the core of horse-shoe shape, in order that the vibrator may be more efficiently attracted.

819,293. ELECTRIC RAILWAY; Mathias A. Lazareff, New York, N. Y. App. filed May 19, 1905. Provides a third rail or conductor which is divided into sections along the roadway, the different sections of which are individually energized as the train approaches by means of mechanical connections moved by the train.

819,322. ELECTRIC SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Nov. 16, 1901. In order to avoid the actuation of signals by "wild" currents from the train motors during its passage, the patentee provides a special relay in the signal circuit which moves under the impulse of direct but not alternating currents, and which is effective to prevent actuation of the signals under such "wild" currents.

819,323. RAILWAY SIGNALING; Jacob B. Struble, Wilkinsburg, Pa. App. filed Mar. 12, 1902. Relates to an alternative construction for accomplishing the same purpose as in the preceding patent. In this case transformers are used which are affected by alternating but not by direct currents.

819,326. CONTROL OF APPARATUS GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; Matthias Van A. Van Wyck, New York, N. Y. App. filed Oct. 26, 1905. A diagram of circuits for the purpose of having the train stops normally in operative position. The train stops are first depressed by the approach of a train, and then again made operative after the train has passed.

819,327. CONTROL OF APPARATUS GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; Matthias Van A. Van Wyck, New York, N. Y. App. filed Nov. 10, 1905. Relates to modifications of the above.

819,355. POTENTIOMETER; Morris E. Leeds and Edwin F. Northrup, Philadelphia, Pa. App. filed Aug. 2, 1905. Has a fixed drum with a resistance wire spirally wound thereon and a casing having a brush which moves spirally over the resistance wire and continually engages the same.

819,360. ELECTRICAL SWITCH; Walter S. Mayer, Philadelphia, Pa. App. filed Mar. 22, 1905. Detailed construction of a circuit breaker having certain specified link and toggle connections.

819,389. ELECTRIC WIRE TERMINAL; Joseph D. Warren, Providence, R. I. App. filed Mar. 2, 1905. A terminal for dry batteries designed to prevent the terminals from working loose. The terminals have two spring leaves, and have protuberances to engage recesses on the nuts.

819,397. RAILWAY SIGNAL; Rollin A. Baldwin, South Norwalk, Conn. App. filed Feb. 16, 1904. A simple apparatus for accomplishing all the purposes of a block signal system on a trolley line with turn-outs. A special circuit wire fed from the trolley by the passage of a car has magnets which illuminate or extinguish the signal lamps as required.

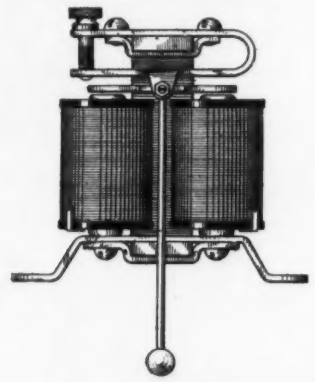
819,410. MANUFACTURE OF CHLORIN; Adolf Clemm, Manheim, Germany. App. filed Feb. 27, 1905. The herein-described process of manufacturing chlorin and at the same time phosphate soluble in a solution of citric acid which consists in first preparing a combined solution of acid phosphoric acid salt, and a chlorid and then subjecting the said combined solution to the action of an electric current, as and for the purpose set forth.

819,418. ELECTRICAL RECEPTACLE; Philip H. Fielding, New York, N. Y. App. filed Nov. 27, 1904. A very efficient form of incandescent lamp socket adapted particularly for the purpose of exterior wiring. The socket or receptacle is made wholly of porcelain, the parts of which are connected by a single screw. A ready means is provided for the attachment of the circuit wires to the metallic parts, and in addition to these features circuit wires are spaced away from the supporting structures so as to satisfy all fire regulations.

819,437. MEANS FOR PACKING JOINTS; James H. Jones, Chicago, Ill. App. filed Dec. 5, 1904. A rubber packing ring is placed around the incandescent lamp, and in engagement with the socket, so as to form a seal to preclude the ingress of moisture.

819,468. TOY FISH TANK; Ernest T. Sulzer, New York, N. Y. App. filed May 11, 1905. An apparatus for pleasure gardens embodying a large circular tank in which toy fishes containing magnets float. Other powerful magnets are rotated beneath the tank so as to impart motion to the toy fishes.

819,522. TELEPHONE-TRANSMITTER; Elmer R. Corwin, West Lafayette, and Frederick R. Parker, Lafayette, Ind. App. filed May 6,



819,049.—Electric Bell.

1903. In a transmitter, the combination with the speaking-diaphragm thereof, of a projecting pin making contact therewith, an insulating-disk to which the projecting pin is secured, and a secondary diaphragm resting against the insulating-disk, substantially as described.

819,524. OIL BREAK DEVICE FOR ELECTRIC SWITCHES AND CIRCUIT BREAKERS; James H. Delany, Wilkinsburg, Pa. App. filed Aug. 12, 1904. In order to obtain a circulation of the oil and thus insure destruction of the arc, the patentee makes the movable element of his switch in the form of a piston which impels the oil through special passages.

819,525. RAIN ALARM; Vincent A. Dever, Philadelphia, Pa. App. filed May 9, 1905. A device for alarming the sleeping occupants of a house when it rains on a hot summer night and the windows are open. Has a piece of blotting paper which gets heavy when wet and completes an alarm circuit.

810,531. MOUTHPIECE FOR TELEPHONES: Frank C. Fisher, Cheltenham, Pa., and Walter C. Culin, Camden, N. J. App. filed Oct. 30, 1905. A mouthpiece comprising a section of hard rubber or analogous material, and a metallic body carrying the said section and having one of its ends extended beyond the section and provided with means for effecting connection between the mouthpiece and a support and also having its opposite end extended beyond the section to protect the same against blows.

819,559. CIRCUIT BREAKER; Joseph La Cos, Schenectady, N. Y. App. filed Aug. 25, 1904. The usual detent of a magnetic switch is in the form of a small roller in order to avoid sticking of the switch by reason of frictional surfaces.

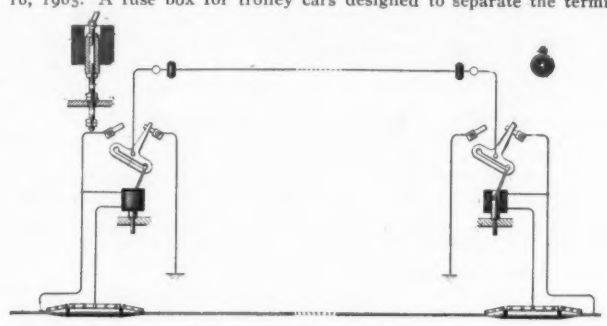
819,560. METHOD OF PRODUCING A CONSTANT MAGNETIZATION BY MEANS OF ALTERNATING CURRENTS; Marius C. A. Latour, Paris, France. App. filed Sept. 10, 1904. The method of producing a substantially constant unidirectional flux in a magnetic circuit, which consists in producing therein a plurality of magnetomotive forces each varying as the square of a sine function.

819,563. ELECTRIC MOTOR CONTROLLER; John B. Linn, Schenectady, N. Y. App. filed Mar. 1, 1902. Details of an elevator controller, the principal feature of which is the arrangement of nesting the various segments and the separating insulation together in a row so that they are obliged to turn with each other and with the controller shaft.

819,571. ALTERNATING-CURRENT MOTOR CONTROL; Maurice Milch, Schenectady, N. Y. App. filed Jan. 15, 1904. In combination, in an alternating-current-motor, a rotor-winding provided with a commutator, brushes short-circuiting the rotor-winding on a line displaced from the line of magnetization of the primary member, a switch adapted to close the rotor-circuit on a second line at an angle to the first, and electromagnetic controlling means adapted to operate said switch when the motor is up to speed.

819,572. ALTERNATING-CURRENT MOTOR AND STARTING-SWITCH; Maurice Milch, Schenectady, N. Y. App. filed Sept. 9, 1904. In an alternating-current motor, a rotor-winding provided with a commutator, commutator-brushes and connections short-circuiting the rotor on a definite line, a starting-switch for the motor having a movable switch member adapted to close the circuit of the rotor-winding on a second line at an angle to the first, and means for retarding the movement of said switch member.

819,608. FUSE BOX; Earl Sherwood, Honesdale, Pa. App. filed June 16, 1905. A fuse box for trolley cars designed to separate the terminals



819,397.—Railway Signal.

when the fuse blows. The terminals are formed by the extremities of spiral springs which are tensioned to separate from one another.

819,613. CONTROLLING THE SPEED OF MOTORS; Charles P. Steinmetz, Schenectady, N. Y. App. filed Sept. 26, 1902. The combination with a multipolar electric motor, of means whereby the active armature circuit may be of the parallel-wound or series-wound type, at will, the number of poles of the motor remaining unchanged.

819,620. METHOD OF OPERATING CONSTANT CURRENT TRANSFORMERS; Matthew O. Troy, Schenectady, N. Y. App. filed Dec. 12, 1903. In order to avoid the inefficiency of a constant current transformer when used on light loads due to the excessive separation of the primary and secondary coils, the patentee cuts out portions of the primary on light loads, so that the coils can work nearer together and therefore more efficiently.

819,624. INCANDESCENT ELECTRIC LAMP; Howard I. Wood, Schenectady, N. Y. App. filed Oct. 31, 1904. The combination of a vitreous envelope, a thin metal band shrunk, while the parts are hot about a portion of the envelope so as to make intimate contact therewith, and a metal conductor or wire passing through the envelope from the inside and making contact with the band or ring on the outside.

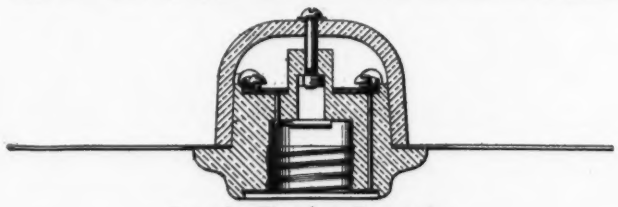
819,625. ELECTRIC MUFFLE; Erland Zell, Schenectady, N. Y. App. filed Oct. 28, 1902. In a furnace, an iron heating member and a heat-insulating packing therefor, containing calcium carbid in granular form.

819,626. MOTOR STARTING AND REGULATING RHEOSTAT; Paul H. Zimmer, Schenectady, N. Y. App. filed June 28, 1905. A combined motor starter and controller having starting resistances and controlling resistances. The starting arm returns to zero position after the motor is running normally, and thereafter the controlling arm can be manipulated.

819,627. PROTECTIVE MEANS FOR ALTERNATING CURRENT SYSTEMS. Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed July 16, 1903. An attachment to avoid the failure of the usual reverse current relays which protect A. C. generators in case of a short circuit. Patentee provides means for temporarily energizing the potential coil of the relay after the short circuit occurs no matter how absolute or serious it may be.

819,645. SNAP SWITCH; Henry Heisenhoner, Schenectady, N. Y. App. filed May 10, 1902. Construction of snap switch having a spring impelled switch element restrained by a detent, and cam means for displacing the detent after a predetermined rotation of the turn button.

819,650. ELECTRIC HEATER; Johannes Harden, Schenectady, N. Y. App. filed Mar. 27, 1905. In order to avoid the increase of resistance



819,418.—Electrical Receptacle.

which ordinarily takes place when an ordinary metallic resistance medium is heated, the patentee combines an additional resistance of a negative temperature co-efficient so as to compensate for the increased resistance.

819,654. FLEXIBLE SHEET RESISTANCE; Harry E. Heath, Lynn, Mass. App. filed Dec. 12, 1904. A construction of C-shaped porcelain beads which can be woven together upon a resistance wire so as to make a complete resistance element of flexible character.

819,657. CARTRIDGE FUSE AND FUSE BLOCK; Harvey Hubbell, Bridgeport, Conn. App. filed Oct. 29, 1904. The fuse terminals are depressed below the surface of the switchboard panel, and the fuse has projecting extensions which engage said depressed terminals. The purpose is to avoid persons making improper connections with pieces of wire, etc.

819,677. ELECTRIC BLOCK SIGNAL SYSTEM; Paul J. Simmen, Chico, Cal. App. filed July 31, 1905. A series of conductors are disposed in over-lapped relation along the length of the roadway, and a shoe on the train makes connection with one or two sections ahead so as to determine the position of trains on the preceding blocks.

819,702. LOCKING SOCKET FOR ELECTRIC LIGHTS; Jeremiah Murphy, Chicago, Ill. App. filed June 11, 1904. An arrangement to preclude electric lamps from being stolen. The lamp shell has ratchet teeth embossed thereon and a special cap is included in the socket to engage such ratchet teeth and lock the shell against movement, unless such catch is displaced by the insertion of a suitably formed tool.